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AGRICULTURAL ENGINEERING

JANUARY • 1949

Some Results of a Study of the Movement of Surface Wind *Austin W. Zingg*

Some Aspects of Rural Electrification in Great Britain *F. E. Rowland*

Application of Hydraulic Remote Control to Farm Implements *E. W. Tanquary*

The Design Procedure for Portable Sprinkler Irrigation *A. W. McCulloch*

Developments in Poultry and Dairy Barn Ventilating Equipment *Nolan Mitchell*

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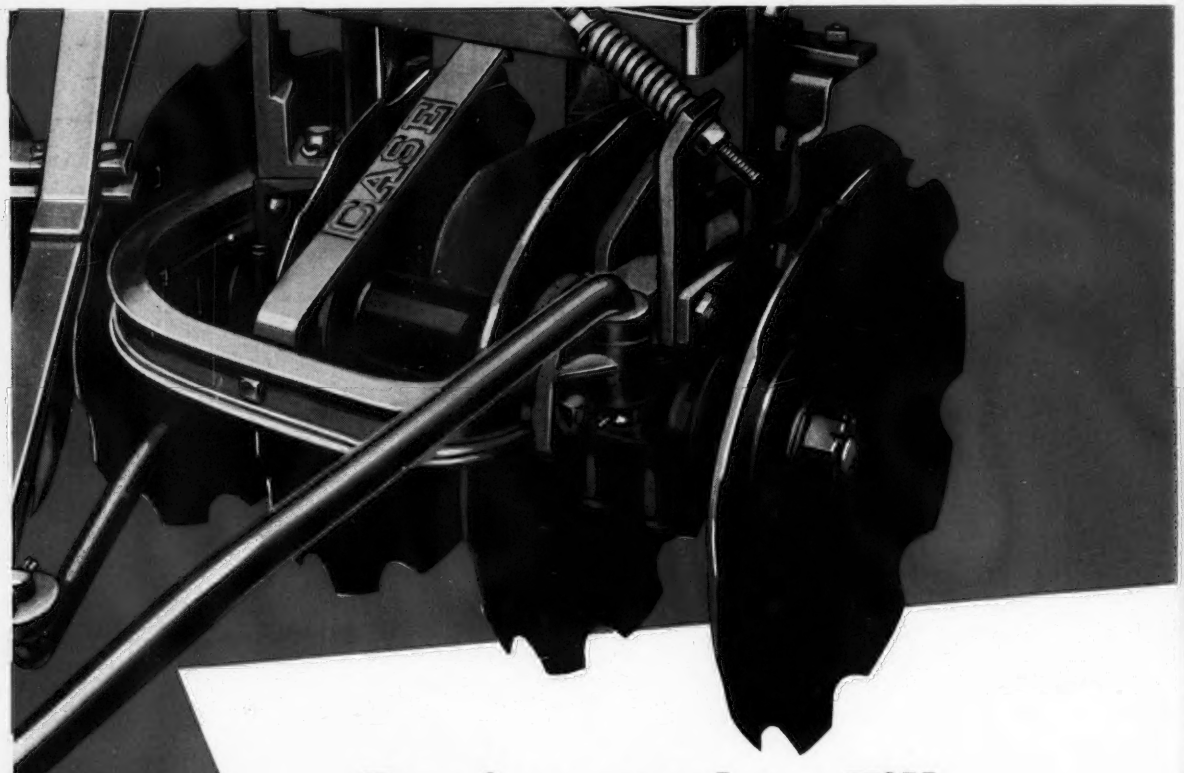

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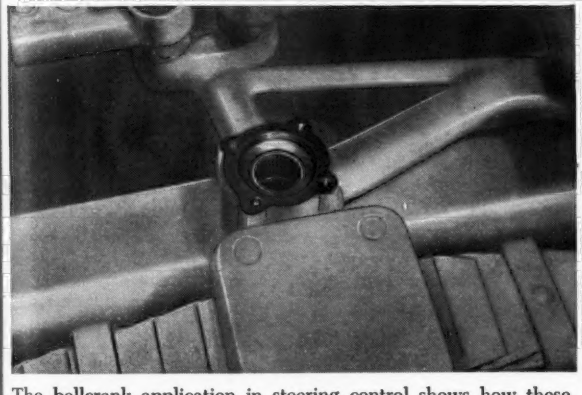

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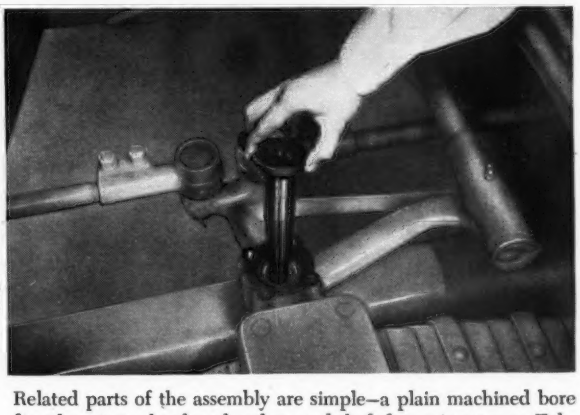

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EDITORIAL

Accessibility of Information

IN RECENT years the Research Committee of the Farm Equipment Institute has sponsored, during the winter meeting of the American Society of Agricultural Engineers, a desirable evening get-together of agricultural engineering research leaders in public service and executives and engineers of various large and small farm equipment manufacturers.

At the session held last month the discussion seemed to us to point to one major proposition: the increasing world crop of scientific information has outgrown the means and methods by which it is harvested, threshed, separated, classified, stored, delivered, and otherwise made available to potential users. Many of the latest and most valuable results of research are locked up for long periods in the process of being made permanently available in standard reference works; or only slightly better, are brought to limited public notice by preliminary publication in forms not covered by reference indexes or abstracts. Potentially valuable kernels of information, and viewpoints on problems and approaches, remain hidden by lack of publication or by inadequate indexing.

Tons of technical information are being winnowed by slow hand methods to glean the few grains of knowledge applicable to a specific problem. In other cases research and development engineers find it easier and quicker to redevelop much of the information applicable to their specific problems than to look for it in the stockpile of existing information.

It seems that science has been applied more effectively to problems other than that of making scientific information more accessible. Engineers have been too busy improving equipment and methods for others to give proper attention to their own operating efficiency. The industrial world has been given jet propulsion by treadmill methods of processing information.

The problem of making information more readily and widely available is common to all fields of applied science. It is particularly acute to agricultural engineers and the farm equipment industry because of the wide range of information from which bits must be selected and combined to produce patterns of knowledge which can result in still better farm equipment.

The very fact of farm equipment industry executives and engineers and public service agricultural engineers getting together to explore the problem is an encouraging sign.

It is acknowledged that considerable progress has been made in partial solutions to the problem. Publications, abstracts and digests, indexes, other tools of library science, moving pictures, slides, microfilms, computing machines, improved communications, trade association activities, Patent Office files and other government services, and the various scientific, technical, and professional societies have all helped to make existing useful information available.

Still the problem has gotten out of hand. An agricultural engineer undertaking a specific project just about needs an index to available indexes in order to begin to assemble the existing information which may apply to his problem. And some of the best and most timely information he needs, while actually in existence, will not be available in standard publications, and will not be covered by any available indexes.

Pending some more satisfactory solution to the over-all difficulty of making new scientific information more accessible, it is possible that agricultural engineers and the industries serving agriculture may be able to do something more on their own, to bring more agricultural engineering information out into the open.

Considerations of timeliness, completeness, permanence, and ease of reference suggest an indexed and cross-indexed periodical digest of the projects, lines of approach, sources of information, contacts, progress, preliminary results, final results, and interpretations of results of a large percentage of the agricultural engineering work being done in the United States, both in public service and in private industry. The greatest need seems to be for an up-to-date quick-reference guide to the most promising sources of more detailed information on any agricultural engineering subject.

Any such project would present substantial production and financing difficulties. It appears that they might be overcome if or when it becomes clear that they would be less than the difficulties resulting from not having new agricultural engineering information readily available.

A Weakness of Collective Systems

ONE important characteristic of the human race is commonly overlooked by professional advocates of collective economic systems, and by their followers.

The individual human being is the basic, functional, operating, biological, physical, and spiritual unit — the primary entity of the race. Any smaller unit of the race lacks capacity for independent action or existence. Any larger unit is an artificial expedient of limited function, arranged by individuals to serve the individual purposes of all or some of them.

This individual unit of the race happens to have an instinct for self-preservation which is usually stronger than his urge to preserve some larger unit of which he may be a part. The man on the street is more concerned with his well-being and that of his family and close friends than he is with that of some stranger in the next block, the next county, state, or country, whom he may never see or know personally.

He hopes that the larger groups to which he belongs, by choice or necessity, will help improve his individual well-being. He may think it nice if at the same time the group action takes care of others, or unfortunate if it operates to their disadvantage, but he is far less vitally concerned with their welfare than with his own.

What is the significance of this human trait?

It means that the individual will work more industriously for an early direct return to himself and his dependents, than to contribute to a group pool from which his return is not directly related to his contribution.

It means that a group of individuals each working freely and directly for his individual welfare, will produce and receive more and better goods and services than if working for a fixed share of the group's total production.

It means that practically every member of any collective, communal, or socialistic economic system among human beings will work against its success in one of two ways.

He may become a drone, accepting his common share in the output of the group, while contributing as little as possible. Or, if he has ambition, he will try to get more than his apportioned share of the group's total production, either by holding out as much as possible of his own production, or by misappropriating what he can from the production of others. Most will continue to work for themselves as directly and effectively as they can under the circumstances, with such subterfuges as may be necessary.

It means that any such system can appeal only to human drones, to the misinformed, and to the leaders who hope to operate the system to their own advantage, actually as a predatory type of private enterprise for their personal profit.

To the latter, collective theory is stock in trade for a wholesale confidence game of the most vicious sort. They practice predatory private enterprise to condemn productive private enterprise; and sell apparent collective equality with appeals to personal advantage. The inconsistencies are hidden by a confused profusion of misinformation and vituperation.

They have been followed by some people who apparently should have the intelligence to understand human nature and some of the factors influencing human action. The support of some of these people for a workable economic system may be regained if they are shown that collective systems are actually contrary to human nature.

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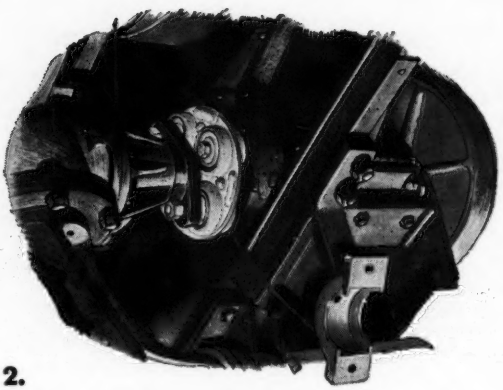
Wanted: a one-man crew to harvest grain in labor-short areas. Cockshutt Plow Co., Ltd., Brantford, Ont., built such a harvesting combine. But trouble-free operation had to be assured on such vital turning parts as the shaft between transmission and differential. Needed: a flexible coupling to absorb shock and vibration, increase shaft life, yet withstand grit, chaff and moisture. Impossible?...



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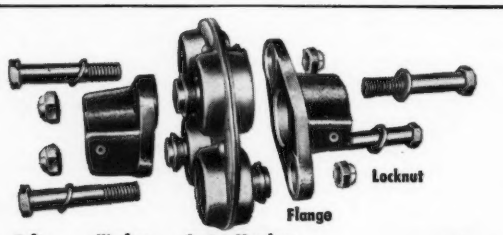

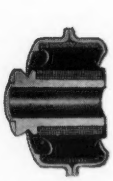

Cross section showing detail of pre-loaded rubber biscuit.

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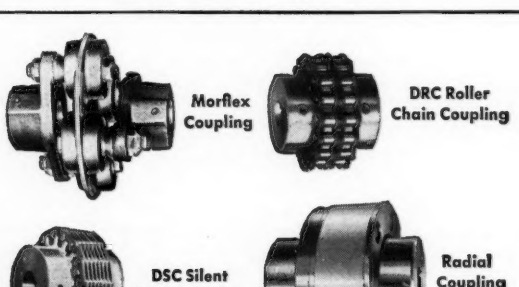

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VOL. 30 JANUARY, 1949 NO. 1

A Study of the Movement of Surface Wind

By Austin W. Zingg

MEMBER A.S.A.E.

WIND IS THE primary force common to soil blowing in the high plains area. A comprehensive understanding of the phenomena is basic to the design of measures to alleviate the problem. Particularly is it true that program of research on soil erosion by wind cannot be conceived without taking cognizance of the natural forces involved. The purpose of this paper is to develop and present methods of approach to the analysis of records of wind movement.

When thinking of soil movement by wind, this universal question comes to mind: How, when, why, where, and how much does the surface wind blow? In striving to find answers to these questions, one is confronted almost immediately with the fact that very little analytical work on the subject has been done. It is true that many readings of wind velocity have been recorded; however, one will find that records at a given location usually do not have continuity with respect to time, environment, elevation, instrumentation, etc. Again, upon comparing records from one location with those of another, non-uniformity in the same items is to be found. This condition is a natural characteristic of development, growth, and the changing demand for the collection of weather data; consequently, it is necessary to make adjustments in the data as collected before they can be analyzed on either a qualitative of quantitative basis. This has not been done. Methods of describing and estimating the characteristics of wind, in manners analogous to those developed for the science of hydrology, do not exist.

In this treatise the author has attempted to adjust and interpret some items common to the longest record of wind velocity available in the state of Kansas. Measurements of wind movement at Dodge City have been made by the U. S. Weather Bureau since 1875.

Dodge City is a historic point on the Old Western Cattle Trail from the Southwest. It is located in the 20-in rainfall belt on the eastern edge of the Great Plains.

Adjustment of Wind Velocities to a Common Base. Records of wind movement have been obtained in and near Dodge City with a cup-type anemometer located at eight different points during the 74-yr period of measurement. Pertinent data regarding these locations are given in the following tabulation:

Date Started	Location	Gage height above ground, ft	Gage elevation above sea level, ft
1874, Sept. 15	Dodge House, Chestnut and Railroad	54	2553
1876, June 5	Lake Building, Walnut and Second	54	2557
1883, Jan. 1	Hoover Building, Front Street	54	2557
1886, Sept. 1	Palace Drug Store, Front Street	54	2563
1909, Nov. 22	Weather Bldg., Central and Spruce	51	2573
1931, April 7	First National Bank	100	2578
1932, May 21	Post Office, Central and Spruce	86	2585
1942, July 1	Municipal Airport, 2.8 mi east of postoffice	58	2652

The first four locations of the gage, yielding the record for 1874 to 1909, are at equal height above the ground, and their sea level elevations vary but little. For adjustment purposes the records for this period have been considered by the author to be representative of those from one location. The records from the remaining four locations are considered separately.

Before adjusting the measurements to represent historic velocities at one location, the author converted to true velocities[1] the published values of wind movement for each month of the entire record. Briefly this constitutes a calibration adjustment of the data as secured directly with an anemometer. True velocities for each of the calendar months were then averaged to yield the pattern and level of wind movement for each of five locations on an annual basis for the length of record available. A plotting of the values obtained is shown in Fig. (1a).

An inspection of Fig. 1(a) reveals that the average monthly values of wind movement have varied greatly according to the location of the anemometer. It will also be noted that the differences in the levels of lines, representing records at different locations for several years' time, may be well represented by additive constants of variation. Another point of interest is that values of velocity for the winter months fit into a more regular pattern than do those of the spring and summer months. Obviously the present location of the gage yields wind velocities in the neighborhood

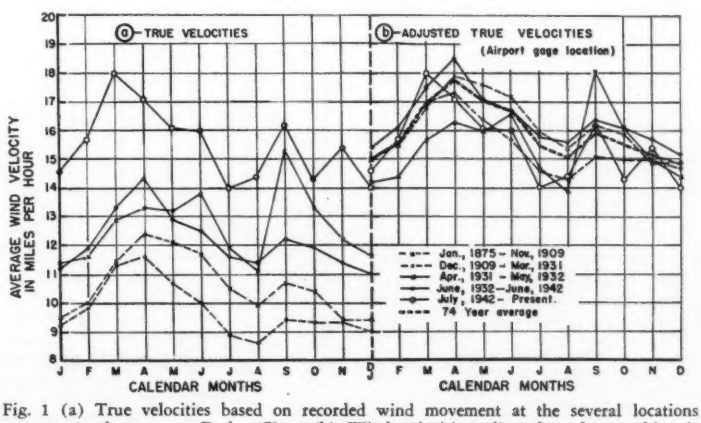


Fig. 1 (a) True velocities based on recorded wind movement at the several locations common to the gage at Dodge City. (b) Wind velocities adjusted to form a historic record for the present location of the gage at the Dodge City airport

This paper was prepared expressly for AGRICULTURAL ENGINEERING. Authorized for publication as Contribution No. 402, Kansas Agricultural Experiment Station and Soil Conservation Service, cooperating.

AUSTIN W. ZINGG is project supervisor, wind erosion mechanics research, Soil Conservation Service (Research), U.S. Department of Agriculture. (Author's address: Agronomy Dept., Kansas State College, Manhattan)

AUTHOR'S ACKNOWLEDGMENT: Acknowledgment is made to D. A. Russ, agricultural aide (SCS), for assistance in assembling and processing the data necessary to this manuscript, and to Ralph V. Hanlon, in charge of Dodge City (Kansas) office, U. S. Weather Bureau, for his help in assembling and interpreting basic data.

[1] Fergusson, S. P. and Covert, R.N. New Standards of Anemometry, Monthly Weather Review, vol. 52, no. 4, p. 216-218, April, 1924.

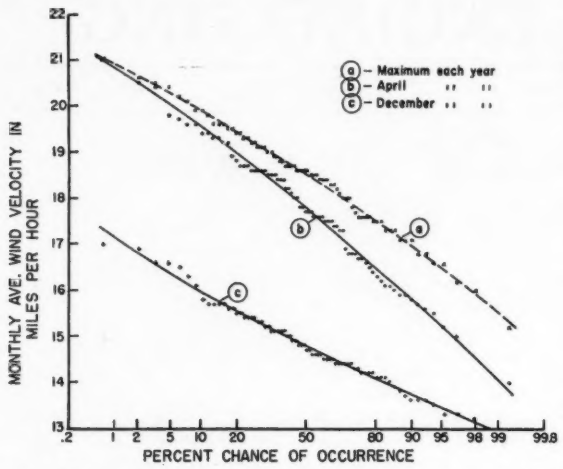


Fig. 2 Plotting of monthly averages of wind velocity as a probability series for the period 1875-1948

of 4 to 5 mph greater than records obtained prior to 1930. This is to be expected from a consideration of the present unobstructed location and elevation of the anemometer. The gage is located presently on the upland. It was formerly above the flood plain of the Arkansas River.

For future reference it would be of most value to have all velocities adjusted to the present location, the municipal airport, where records are obtained with an anemometer 58 ft above the ground surface at an assigned elevation of 2652 ft. This procedure was adopted. The results of such adjustment are shown in Fig. 1(b). An explanation of the details of adjustment is contained in the Appendix.

A heavy line representing the average wind distribution by months is also shown in Fig. 1(b). It is of interest to note that the greatest intensity of wind movement occurs in April. This is the time of year when the winter wheat crop is emerging from a more or less dormant condition. If the fall-seeded crop has made a poor growth, living vegetal cover will be meager. The month of April is normally a critical one for the movement of soil by wind.

Probability of Occurrence of Velocities of Various Magnitudes. Estimates of the frequency of occurrence of a given flood on a stream, or of intensities of rainfall for given time periods, are made commonly by probability methods. It is reasonable to expect that the magnitude of wind movement should also be amenable to estimation by similar devices.

To test this premise, the adjusted values of wind velocity were subjected to treatment by the criterion described by Hazen[2]. The formula used was $P=(2m-1)/2n$, where P designates the plotting position in per cent of time; m, the number of the observation as determined by its sequence in a descending series, and n, the total number of years in the series.

Plotting of the values for wind velocity on Hazen's probability scale, using an arithmetic ordinate, resulted in frequency curves as shown in Fig. 2. To avoid confusion only the maximum average monthly velocity for each year (a), the average velocity for the month of April for each year (b), and the average velocity for the month of December for each year (c) are plotted in the figure.

One concludes that the distribution of wind velocities of various magnitudes at a given location tends to approximate the normal law of chance; and, further, that the frequency of occurrence of a given intensity can be estimated by probability methods.

Considering values from the curves of Fig. 2, it will be noted that the range of average wind velocities for the month of April varies from approximately 21 to 14 mph at the 1 per cent and 99 per cent points, respectively. In other words, there is an equal chance of obtaining either extreme of velocity 1 per cent of the time. Upon first consideration, it may appear that this difference is not great; however, it should be remembered that the drag of wind on the land surface is proportional to the square of the velocity, $\tau \propto V^2$. Assuming that the movement of air were uniform under the two extremes, the magnitude of τ would be $(21/14)^2$, or 2.25 times as great for the 21 as for the 14-mph wind.

The fact that the data fit smoothly into probability series gives some assurance that the velocity adjustments as made by the author are reasonable. If the data shown in the probability series are accepted as a representation of fact, it is found that for the month of April the 5 years of highest wind movement rank in the order 1877, 1896, 1935, 1884, and 1879. The slope of the curve near the upper limit of plotted points is also such that wind movement greater than any which has occurred during the 74 years of record is well within the range of probability.

Deviation of Hourly Wind Movement from Monthly Average. The level of wind intensity, as an average for a month, undoubtedly bears a relationship to the soil-blowing problem. The picture is not complete, however, without a measure of the departure of velocities for short-time periods from an average monthly value.

The variation in wind movement from an average may be shown by a dimensionless plot of velocity and time. In this instance, the deviation of each hourly velocity from the average for the month was determined. After each of the 720 values for a month was placed in a decreasing series, a curve was drawn through them to represent the time a given velocity was equalled or exceeded.

Intensity-duration curves for the month of April for several years are shown in Fig. 3. The years for which curves are derived were selected arbitrarily at 6-yr intervals, starting with 1917 and ending with 1947. It is to be noted that the shape of the several curves does not vary greatly from year to year. On the average, wind velocities for the month of April exceed the mean value 50 per cent of the time. They exceed the average by 10 mph about 10 per cent of the time.

The measured true average velocities for April of the years shown are tabulated in Fig. 3. Recorded also are average velocities derived to represent historic conditions at the present location of the gage.

Characteristics of Wind Storms. High winds or "blows," as they are called in the Great Plains, appear to have the characteristics ascribed commonly to the word "storm."

Diurnal variation in wind movement is recognized generally. A clear explanation of this phenomenon is given by Brunt[3]. Typical of such variation, near the ground surface,

[2]Hazen, Allen. Flood Flows. John Wiley & Sons, 1930.

[3]Brunt, Davis. Physical and Dynamical Meteorology. Cambridge University Press. Second Edition. Reprinted 1944.

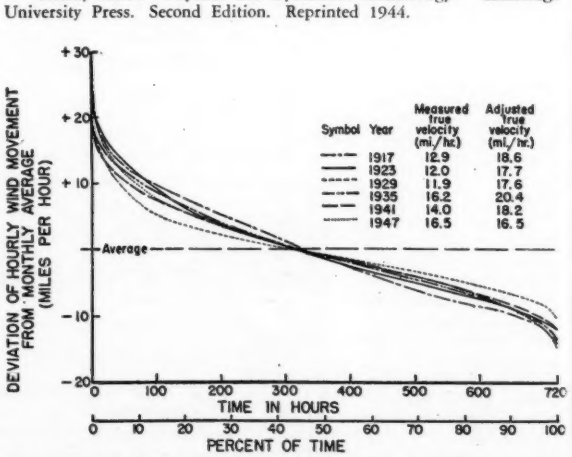

Symbol Year Measured true velocity (mi./hr.) Adjusted true velocity (mi./hr.)
1917 12.9 18.6
1923 12.0 17.7
1929 11.9 17.6
1935 16.2 20.4
1941 14.0 18.2
1947 16.5 16.5
Average
DEVIATION OF HOURLY WIND MOVEMENT FROM MONTHLY AVERAGE (MILES PER HOUR)
TIME IN HOURS
PERCENT OF TIME

Fig. 3 Deviation of hourly wind movement from the monthly average

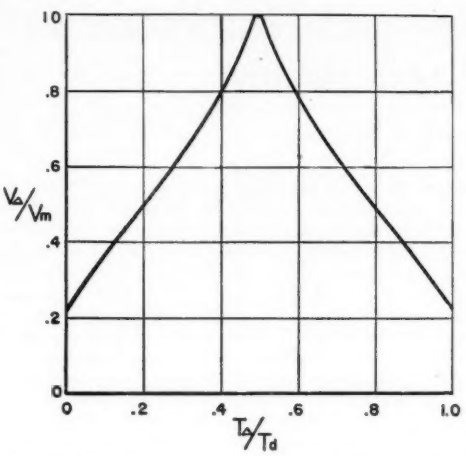


Fig. 4 Average dimensionless pattern of windstorms based on data from twelve storms occurring during April, 1935

is a slackening of the wind during the night. This normally occurs during inversions of temperature. With an adiabatic state of the atmosphere during the day, velocities near the ground surface increase. The peak of velocity associated with diurnal variation usually occurs in the afternoon. A plot of this variation for the Dodge City location is shown in a recent publication by the Kansas State Board of Agriculture[4].

A windstorm represents a marked ascension in wind velocity for possibly 36 to 72 hrs. During this time diurnal fluctuations may be superimposed upon the ascending or descending limb of the storm, but they are, in the main, of a secondary nature.

To describe a typical windstorm, twelve of them occurring in April, 1935, were averaged in dimensionless form. The result is shown in Fig. 4, wherein the ratios $V\Delta/V_{max}$ to $T\Delta/T_D$ are plotted. The symbols referring to a specific storm are defined as follows:

$V\Delta$=hourly wind velocity at a given time

V_{max}=maximum hourly wind velocity

$T\Delta$=time from beginning of storm

T_D=time of storm duration

A study of the dimensionless plots of the twelve storms indicated that the peak of intensity of wind movement came, on the average, at the midpoint of storm duration. This point was confirmed by the study of many additional storms. Also, on the average, the rise and fall of the wind tended to be equal and symmetrical. Again no particular hour for the beginning, ending, or peak appeared to be characteristic. The dimensionless average storm of Fig. 4 was, therefore, derived by plotting the average duration of all intensities above given levels symmetrically from the midpoint of storm duration. The form of the plot is approximately triangular, and the wind velocity before and after the storm averages about 0.2 of the maximum attained.

It should be recognized fully that the curve of Fig. 4 is an average pattern. Individual storms will differ greatly from this average; further, a specific storm may have many secondary fluctuations in intensity. The average duration of the 12 storms selected for study was 53 hrs, varying from 33 to 72 hrs. The maximum velocity of the average storm for one hour's time was 29 mph, with a variation ranging from 23 to 35 mph. These values were common to the location of the Weather Bureau anemometer in Dodge City during 1935.

Investigation possibilities latent to deriving excess curves, representing wind movement over and above a given velocity, will be apparent immediately to those acquainted with processes of hydrologic analysis.

Discussion and Interpretation of Results. It is believed that much information of practical value to the problems of agriculture remains to be derived from existing climatological data. Possibly no other type of weather data has been so little explored from the standpoint of scientific agriculture as records of wind movement. The fact that records at one station must be subjected to adjustment before analysis can be undertaken presents a difficult but not insurmountable task.

The results of this study indicate that once such adjustments are made, the data on wind movement will permit many analytical approaches similar to those employed presently in the fields of hydrology and flood control.

The analysis presented herein pertains to only one gage at one location. It is further limited to one height above the ground. One of the first steps which needs to be taken to make a record useful to an analysis of the phenomenon of soil erosion by wind is to bring the record down to earth where the problem exists. This can be accomplished with certainty only by installing a recording anemometer or anemometers near the ground surface. If such were properly located, they would provide a tool for converting the large body of data secured at greater heights to a more usable form.

A recognition of the type or pattern of the windstorm associated with soil movement is of importance. It is not inconceivable that the design of measures to control soil drifting will be based ultimately on the probability level of a windstorm, or storms, associated with a condition of drought.

SUMMARY

The purpose of this paper is to develop and present methods of approach to the analysis of records of wind movement with a view to obtaining a better understanding of the characteristics of the natural force encountered in soil erosion by wind. Records of wind movement obtained at Dodge City, Kansas, during a 74-year period were used for the purpose. Certain adjustments in these data were made in an attempt to make them representative of the present location of the gage.

Adjusted monthly averages of wind velocity were found to be amenable to study by probability methods.

Wind intensity-duration curves were developed for wind movement occurring during the month of April for selected years. The general pattern of these curves was found to be similar.

An average dimensionless pattern of windstorms was derived from storms occurring during the month of April, 1935. The peak of storm intensity was found to be at the midpoint of storm duration.

The results of the study indicate that the problem of soil erosion by wind may be approached analytically by methods similar to those employed in the fields of hydrology and flood control.

APPENDIX

As a first step in adjusting the data on wind movement to a common base, a long-time average was obtained for the period 1875-1930. This yielded a long-time pattern of wind movement by months at the average level of 10.3 mph. Since the object was to adjust all data to approximate values for the present location of the gage, the difference between the long-time average, 1875-1930, and the record at the airport location 1942-46 was secured. This difference was found to be 5.2 mph.

From a study of records at Colby and Garden City, it was found that wind movement for the period 1942-48 was approximately 0.4 mph below the level of the long-time average. This value was, therefore, added to the 5.2 difference already obtained. A long-time pattern of wind movement for the airport location was then established at the average level of 15.9 mph.

(Continued on page 19)

[4]Climate of Kansas. Report of the Kansas State Board of Agriculture, vol. LXVII, no. 285, p. 251, June, 1948.

Some Aspects of Agricultural and Horticultural Electrification in Great Britain

By F. E. Rowland
MEMBER A.S.A.E.

MAY I commence by saying how honored I feel by being invited to address this meeting, and although I come from a different continent over 3,000 miles away, by my participation a third English-speaking country bordering on the North Atlantic is represented. I have been associated with agricultural and horticultural electrification for nearly 20 years, and I selected my subject in the hope that I might be able to touch on some aspects which would interest the meeting, particularly with regard to more recent trends and developments. Within the confines of a paper such as this, it is possible only to include a few aspects of the subjects, and even those can only be dealt with superficially.

Due to the urgency for increased food production during the recent war, and the consequent great expansion in agriculture, a large increase in agricultural electrification might have been expected. This, however, did not occur, due to labor and material having to be diverted to even more essential purposes. A notable exception was the introduction of a 3-hp hammer mill, the development of which received government backing, as it provided a means for grinding home-produced cattle feed and resulted in a considerable saving in steel and labor, compared with mills of large capacity which it replaced.

I am not making any claims of merit for the applications and equipment I shall be describing, but have selected them in the hope that some of the information will be novel and interesting.

Electrical Supply. Electricity in Great Britain is almost exclusively generated from coal, except in the extreme north where waterpower is employed by the North of Scotland Hydro-Electric Board, but this does not materially affect the overall position. Before April 1, 1948, there were nearly 600 separate electricity supply undertakings, some controlled by municipalities and some by private companies, 80 per cent of the rural areas being in the hands of the latter. The large number of undertakings resulted in divergence of policy and enterprise in rural electrification; for instance, in some districts in which urban industries and interests were paramount, there was less interest in the rural load than in areas with little urban development. The Electricity Act, 1947, which came into force on April 1, 1948, set up the British Electricity Authority (B.E.A.) to control generation and primary distribution, and divided the country into fourteen autonomous areas to control secondary distribution and supply to consumers. The act specially emphasizes the importance of energetic and enterprising development of electrification in rural areas.

Rural distribution is generally at a pressure of about 11,000 v, 3-phase, 50 cycles, and farms are supplied at 415 v, 3-phase, 4-wire, which also provides 240 v, single-phase for low power, heating, and lighting requirements. In some districts single-phase at 480/240 v is employed for final distribution. When 3-phase is available it is generally used for motors of over 1 hp and heating loads of over 3 kw. Single-phase distribution is being increasingly employed, particularly for isolated premises; it is cheaper, and the objection of the higher price and poorer starting characteristics of single-phase motors are no longer considered serious objections. The practice is increasing of taking the high-tension distribution into the consumer's premises and supplying him through a separate transformer.

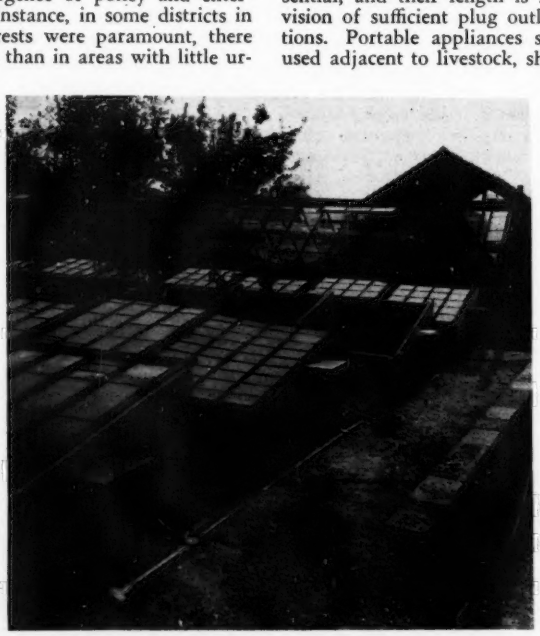
Farm rates are generally of the two-part type, the standing charge being based on some factor such as floor area, and the running charge being of the order of 1 d per kw-hr. Consequently farmers using electricity to an appreciable extent obtain it at an all-in rate of about 1½ d per kw-hr.

An important development in recent years is the use of apparatus to improve load factor. Examples are small grinding mills and thermal storage dairy sterilizers and steam raisers, to which further reference is made later.

Farm Wiring. As a rule farm wiring is installed in existing buildings, the method most widely employed being tough-rubber-sheathed cable and plastic accessories. Lead-covered wiring and galvanized steel conduit tubing are also used to a lesser degree, but are liable to corrosion in certain situations. Great emphasis is laid on satisfactory grounding, and where there is doubt as to its effectiveness, earth-leakage circuit breakers are recommended. They are designed to disconnect the fault automatically when the potential between it and ground exceeds 40 v.

Another system of wiring employs tough-rubber-sheathed cable with waxed cotton braid embedded in the sheath, as a protection against oil and sunlight. The cable is generally of 2 or 3-core construction, with an integral grounding core.

The use of flexible leads are discouraged, except where essential, and their length is kept to a minimum by the provision of sufficient plug outlets adjacent to operational positions. Portable appliances such as handlamps and clippers used adjacent to livestock, should be supplied at low voltage, e.g., 24 v through either fixed or portable transformers.



This picture shows the use of four 2½-kva soil-warming transformers in connection with cold frames

Farm Lighting. Electric lighting on farms has in the past been installed in rather a haphazard manner, and it is only in recent years that it has received the technical consideration it warrants. Tungsten filament lamps are generally employed, although fluorescent lighting is becoming popular in milking sheds. On account of the short lighting hours in these situations, it is difficult to justify this method of lighting on an economical basis, and its use may generally be attributed to a desire to be up-to-date. The standards of illumination which are recommended are as follows:

The service illuminations given below do not allow for ageing of the light sources and falling off in efficiency of lighting fittings, walls, and ceilings due to deterioration and the accumulation of dust and dirt.

This paper was presented at a meeting of the North Atlantic Section of the American Society of Agricultural Engineers at Guelph, Ont., Canada, September, 1948.

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To compensate for these effects, the initial illumination values should be 40 per cent greater than those given.

	Recommended Service Illumination on Horizontal Plane at Working Level (Lumens per square foot)
Milking shed and parlor	6 - 10
Dairy (milk room)	"
Washing and sterilizing	"
Implements (maintenance)	"
Calving boxes	"
Workshop	"
Farrowing pen	"
Food preparation	4 - 6
Cow standings (not used for milking)	"
Stalls and loose boxes	2 - 3
Barns and spaces for storage	1 - 2
Passages	"
Covered yard	"
Open yard	0.5 - 1

In most situations dispersive reflectors may be employed, but in locations which are specially exposed to moisture, dust, or mechanical damage, wellglass or bulkhead fittings are preferable. Lighting in passages, stairways, and spaces with more than one entrance should be controlled by two-way switching.

To comply with the Ministry of Health's requirements for the production of Accredited and Tuberculin Tested milk, steam sterilizing of dairy utensils and milking machines is widely employed on farms in Great Britain. If it had not been for the war, it is probable that by now all milk for human consumption would have been produced to one of these standards and steam sterilizing universally employed.

Portable utensils are sterilized in a chest in which the temperature is raised to 210 degrees F and held for ten minutes. Milking-machine teat-cup clusters are sterilized by blowing steam through them and maintaining the temperature at 210 degrees F for three minutes, and cans are steamed on a stool or in a chest. Electric sterilizing equipment is widely employed due to considerations for hygiene and labor saving.

Lower steaming temperatures are accepted by the United States Public Health Service which stipulates exposure "for at least 15 min to at least 170 degrees F, or at least 5 min to at least 200 degrees F." Proposals have been made that the standard in Great Britain might be lowered, thereby lessening the operating time and the cost.

ELECTRIC STERILIZING DAIRY CHESTS POPULAR

Dairy Sterilizing Chests. The electric sterilizing chest is the most popular form of farm sterilizer, on account of labor saving, hygiene, convenience, and reliable results. It consists essentially of a galvanized steel cabinet with a small steam generator with immersion heaters mounted beneath it. Means are provided for furnishing an external supply of steam for such purposes as sterilizing teat-cup clusters and milk cans on an adjacent stool or block. A ball valve is incorporated to provide automatic water feed and the heaters are protected with automatic trips, against burning out due to running dry. The complete sterilizing process takes about 1 hour for utensils and 1 1/3 hours for milk bottles. The most popular sizes of chest are those of 19, 27, and 48-cu-ft capacity.

A recent development is the introduction of sterilizing chests working on the thermal storage principle, an iron block containing a 1 kw heater being mounted beneath the cabinet. With from 5 to 7 hrs preheating, sufficient steam is produced to sterilize a load of utensils and three or four teat-cup clusters. The chief advantage of the storage principle is that the loading is reduced from 6 kw to 1 kw, thus improving the load factor and enabling chests to be installed on light distributors, on which a higher loading could not be employed. An incidental, although important functional advantage is that the operating time is reduced, thus enabling work to be finished more quickly.

Steam Raisers. Where a greater amount of steam is required than is obtainable from a dairy sterilizing chest, for instance for a releaser-recorder milking plant, a separate steam raiser or boiler is used. The cows come to the plant for milking in special stalls, and the milk passes into glass jars in which it is weighed for recording. Then it passes through a pipe and a releaser which enables the milk to leave the plant without interrupting the vacuum. Finally it flows over a cooler and into a churn. An improved type of plant has lately been introduced, in which the milk is under vacuum from the teat cups, via the cooler, to the can, and is never exposed to the atmosphere. The number of recorder plants is increasing rapidly, as by their use, there is a saving in labor, time, and capital expenditure. It is only necessary to modernize the small part of the farm buildings in which the milking parlor is situated, instead of a large milking shed, or as an alternative a small inexpensive shed may be provided. After washing with cold and hot water, steam is blown through the milk pipe line and into the recording glass jars and releaser, the steam requirements being approximately 3 lb per unit of plant plus 5 to 6 lb for the releaser. The hot water for washing may be obtained by steam injection from the steam raiser or from a separate water heater.

Direct-heated steam raisers with immersion heaters or electrodes are loaded at 15 to 30 kw, and the thermal-storage type with water or iron-block storage have a loading of 1.5 to 9 kw.

Owing to the absence of dirt, dust, and stoking, electric steam raisers permit the most efficient layout of equipment to be effected, and it is generally possible to put them near the maximum steaming load, and thus prevent waste of energy from long steam pipes exposed to draft.

THERMAL-STORAGE WATER HEATER EFFECTIVE

Water Heating. An ample supply of hot water is essential in a dairy, and this is most effectively provided by a thermal-storage water heater, which ensures that hot water is available whenever required. Factory-made water heaters are most efficient, but to economize in capital cost, existing water tanks may be thermally insulated and fitted with an immersion heater and thermostat. For "quick milking" a water heater with appropriate thermostat setting may be installed in or adjacent to the milking shed.

Grain Drying. Owing to the humid climate in Great Britain, it is usually necessary to dry grain immediately it comes from the combine; otherwise overheating and deterioration in storage will occur. The grain is therefore passed through a drier equipped with electrically driven fans and a furnace which is generally heated by coke or oil. However, in some instances electric heater batteries have been employed with loadings of the order of 130 kw for a rated throughput of 30 cwt per hr. Grain driers are designed for a moisture extraction of 6 per cent, although in the south and east of England, 2 to 4 per cent is generally sufficient. In order to improve load factor, investigations are in progress to develop all-electric grain drying on a long-time, low-loading basis, and in one experimental drier, the heating load has been reduced to 30 kw for a throughput of 6 cwt per hr. With automatic operation a drier of this type could handle up to 7 tons in 24 hr.

Investigations are also being made into bin ventilation. The grain is stored in concrete bins or silos, and slightly heated air is blown through it for as long as 10 to 14 days. This method has a good electrical load factor and should appeal to farmers who store their grain.

Hay Drying. The British Electrical and Allied Industries Research Association (E.R.A.) has conducted investigations into barn or mow hay drying under British climatic conditions. The work has now reached the stage where its widespread adoption may be anticipated, and it is hoped that it will become as extensively used as in many parts of the United States. Sometimes the rate of progress in Great Britain appears to be slow compared with that in America. It was consequently some consolation to read in Electricity on the Farm Magazine for April, 1948, that it was about ten years since the first mow hay finisher was installed at the University of Tennessee. As experiments in Great Britain have only been in

hand on a national scale for two years, the progress to date is more encouraging than might at first be apparent, particularly as in 1946 the work was retarded by an exceptionally wet season, while in 1947 it was unusually dry.

Motors. Protected-type motors are employed in most situations, but where excessive dust or moisture is prevalent, totally enclosed fan-ventilated machines are preferred. V-rope drives are very popular on account of their short driving centers, silence, and ease of application. The V-flat drive is also employed so as to utilize existing pulleys on driven machines. Where there is a 3-phase supply, it is generally used over 1 hp. Motors up to 2 hp have direct-on starting, from 3 hp to 10 hp star-delta, and above 10 hp slip-ring motors may be employed.

Portable motors are not used to any great extent. For the same cost, two or three fixed motors may be installed, and the time of moving and aligning a portable motor is saved.

E.R.A. DEVELOPS SMALL HAMMER MILL

Small Hammer Mills. Reference has been made to equipment for improving the load factor of farm installations. An outstanding example is a small hammer mill developed by the E.R.A. It is driven by a 3 hp motor and supercedes large mills with motors of 10 to 20 hp running for only a few hours a week. By a suitable layout of grain and meal bins, fully automatic working is possible, and the mill can be operated continuously without attention.

In small installations a grain hopper may be placed over the mill, and a meal bin alongside it, but where a large output is required, it is more effective to place grain bins on the floor above and feed the grain by gravity to the mill. After grinding, the meal may be blown back to the floor above into meal bins for storage and subsequent movement by gravity. In the feed to the mill, there is a flap which controls a switch to interrupt the electricity supply when grain ceases to flow. Long-hour grinding without supervision may be effected by day or night.

Water Pumping. The usual form of applying electric pumping to farms is in conjunction with a tank in the roof. Most farm buildings are low, consequently the water pressure is also low. Pressure pumping systems, however, are becoming more widely used, as the elimination of the overhead tank and the advantage of obtaining water under pressure without an elevated tank are becoming more widely appreciated. For deep-well pumping, submersible pumps are being employed in greater numbers. In order to enjoy the benefit of the pressure system, and to provide a reserve in the event of fire or failure of the pump, an overhead tank and pressure system are combined.

Soil Warming. The expression "soil warming" has superseded "soil heating", which prejudiced some growers by giving them the impression that higher temperatures were involved than is the case. Soil-warming cables were first manufactured in Great Britain in 1931. They were made for 200 to 250 v, with a resistance wire insulated with oil-impregnated paper and asbestos, lead covered, braided, and compounded. Little progress was made, principally because the cables were liable to damage during cultivation or if they were moved. A loading of 10 w per sq ft was employed, with thermostatic control, and the beds were thermally insulated with coke or ash. The cost of installations was high and there was a risk of dangerous shock.

Following a program of research a report, entitled "Simplified Electrically Heated Hotbeds", was published by the E.R.A. in 1942, and with the cessation of hostilities, rapid expansion occurred. The improvements in technique include bare warming wires supplied through transformers, the output voltage being between 6 to 30 v, according to the size of the installation. The warming wire is of galvanized steel to an appropriate electrical specification; it is robust and inexpensive and may be moved without risk of damage. The risk of dangerous shock is eliminated by the low secondary voltage.

Transformers for soil warming must be designed to withstand horticultural conditions and exposure to the weather, and special precautions should be taken to exclude the danger of shock to the user. Desirable features include electrical and physical separation of the input and output windings; a weatherproof case; enclosure and sealing of all parts operating at input voltage; externally mounted output terminals disposed so as to prevent accidental short circuit; a maximum output voltage to ground of 7.5 up to 1 kva or 15 v over 1 kva. To give the requisite loading for a given area, knowledge and experience is needed in the disposition of the heating grids and in the choice of the correct gage and length of wire.

Another feature of the simplified method of heating is the "dosage" system of applying the heat. Instead of employing a specific temperature controlled thermostatically, a dosage of 40 to 50 whr (watthours) per day is given, according to the latitude of the installation. The loading may vary between 2 w and 5 w per sq ft depending upon the number of hours heating per day; the supply is time-switch controlled to give the requisite dosage, and advantage may be taken of short-hour or off-peak concessions in rates. By this method the soil temperature is raised by about 15 degrees F. A further simplification and economy is effected by the elimination of thermal insulation of the beds.

Soil warming is principally applied under frames, dutch lights, continuous cloches, or in glasshouses. Installations range from small amateur frames of 12 sq ft with a loading of 60 w, to commercial holdings with a loading of 50 kw supplied through several transformers. The widest application is for maintaining optimum soil temperature to obtain early-out-of-season crops, and another important use is for prewarming beds to prevent transplanting check with crops such as tomatoes. With electric prewarming the requisite temperature is attained in 10 to 30 hr, eliminating the necessity and uncertainty for making long forecasts before transplanting. There is also a large saving in heating cost, compared with warming the soil by running the air heating system for a long period prior to transplanting. Soil warming is also used for propagating beds and benches. For this purpose a loading of at least 4 w per sq ft with thermostatic control is employed, so as to produce a higher temperature and closer control.

RESEARCH AND DEVELOPMENT IN ELECTRIFICATION

Research and Development. Research is principally conducted by the E.R.A. which receives its funds from the B.E.A., manufacturers of electrical and allied equipment, the Department of Scientific and Industrial Research, the Ministry of Agriculture, and other public bodies. A Rural Electrification Section was formed in 1937 and the detail work is controlled by subcommittees dealing with distribution to farms, agricultural applications, horticultural applications, and small-scale generation. The main committee and subcommittees are composed of representatives of electricity supply, manufacturers, and agricultural and horticultural research workers. Close co-operation is maintained with agricultural and horticultural colleges and experimental and research stations. The investigations of the E.R.A. cover a wide range of subjects and its reports are authoritative and of a high technical standard. Individual manufacturers also conduct research into problems affecting the developments of their own products.

Technical papers on agricultural and horticultural subjects are read before The Institution of Electrical Engineers, The Institution of British Agricultural Engineers and similar institutions. A subcommittee of the Codes of Practice Committee operating under the aegis of The Ministry of Works, is preparing a Code of Practice for Farm and Horticultural Electrical Installations, which when completed will be an authoritative and comprehensive treatise on all aspects of the subject.

Development and propaganda is undertaken by the Area Electricity Boards in conjunction with the British Electrical Development Association (E.D.A.) This work is also in the hands of technical committees representing electricity supply, manufacturing, farming, horticultural, and kindred interests. E.D.A. publishes technical handbooks, produces films and co-operates in organizing electrical exhibits at agricultural shows and exhibitions.

Application of Hydraulic Remote Control to Farm Implements

By E. W. Tanquary
MEMBER A.S.A.E

APPLICATION of ASAE standards for farm tractor power take-off shafts, master shields, and drawbar hitch points has promoted greater interchangeability of power-driven farm implements and eliminated the necessity of the farmer having to purchase a new hitch or modify the old one whenever he changed to a different make or model tractor. The farmer can now easily obtain a properly engineered hitch with a power-line safety shield that will fit and function properly with any tractor and implement combination he is using.

A problem similar to that encountered prior to adoption of the power take-off and drawbar hitch point standard is now confronting the farm equipment industry due to the steadily increasing use of hydraulic power to operate trailing-type farm implements. Hydraulic pressures for farm tractors now on the market vary from approximately 500 psi to over 3,000 psi, and cylinders are available ranging from 1½ to 4 or 5 in in diameter and with a length of stroke from 8 in on up.

There are several distinct types of hydraulic systems now on the market, and cylinders, even though they might be of the same diameter and have a common size of hose outlet, are definitely not interchangeable. In addition to the unsatisfactory operation that would result from attempts to interchange the different types of cylinders, the hazards that would be created by the use of one of the large-diameter, long-stroke cylinders with a tractor providing a 3000-psi hydraulic system on an implement designed for use with an 8 in stroke cylinder can easily be visualized.

Realizing the operator's desire for greater safety and interchangeability, the Advisory Engineering Committee of the Farm Equipment Institute has made an extensive investigation of the factors involved and now submits recommendations to accomplish the following objectives:

1 To describe and define means that will assure dealers and their customers that, if the equipment purchased was built in conformance with the proposed standard, a safe and properly engineered tractor and implement combination will be obtained

2 To eliminate the necessity of supplemental hose lengths or piping for certain types of implements which will facilitate changing cylinders from one implement to another, and reduce the possibility of introducing dirt or foreign material into the circuit which would definitely impair the operation and shorten the life of any hydraulic system

3 Avoid any hookup that might be hazardous to the operator.

To further these objectives, the FEI Advisory Engineering Committee has requested that the American Society of Agricultural Engineers give consideration to the following recommendations, and, if the Society is in agreement, that these recommendations be approved and made available to the farm equipment industry as an official ASAE Standard:

PROPOSED ASAE STANDARD

APPLICATION OF HYDRAULIC REMOTE CONTROL TO FARM TRACTORS AND TRAILING-TYPE FARM IMPLEMENTS

(Limited to farm tractors up to and including 35 dhp maximum)

DEFINITION

The purpose of the Standard is to establish common mounting and clearance dimensions for hydraulic remote-control cylinders and trailing-type farm implements with such other specifications as are necessary to accomplish the following objectives:

1 To permit use of any make or model of trailing-type farm implement adapted to hydraulic remote control with the cylinder furnished with any make or model of farm tractor up to and including 35 maximum drawbar horsepower

2 To eliminate the necessity of supplemental hose lengths or piping for certain types of implements which will facilitate changing the cylinder from one implement to another, and reduce the possibility of introducing dirt or foreign material into the hydraulic system.

STANDARD DIMENSIONS AND SPECIFICATIONS

1 The hydraulic cylinder with hose shall be considered as part of the tractor hydraulic remote control and shall be built to standard dimensions with sufficient capacity

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Report of the Advisory Engineering Committee, Farm Equipment Institute, presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1948.

E. W. TANQUARY is chairman, Advisory Engineering Committee, Farm Equipment Institute, and engineering specialist, farm implement division, International Harvester Co., Chicago, Ill.

AUTHOR'S ACKNOWLEDGMENT: This report represents the joint efforts of the entire membership of the FEI Advisory Engineering Committee, and full credit is given for their many contributions to the project reported. A special subcommittee was appointed to formulate the original program which included E. E. McCormick (chairman), Gerald Geraldson, Martin Ronning, and E. W. Tanquary. L. S. Pfost and W. F. Strehlow have recently been added to this group. Mr. McCormick and Mr. Geraldson, now deceased, have been succeeded by W. H. Worthington and M. D. Stewart. It is particularly fitting at this time that we pay tribute to Mr. McCormick and Mr. Geraldson for their valuable work during the early inception and later development of the proposed standard recommended in this report.

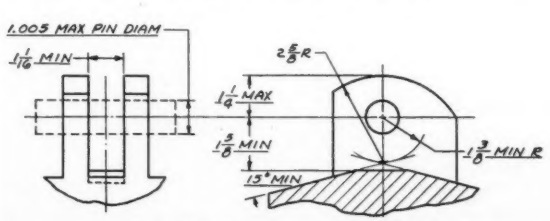


Fig. 1 Yoke clearances — anchor end

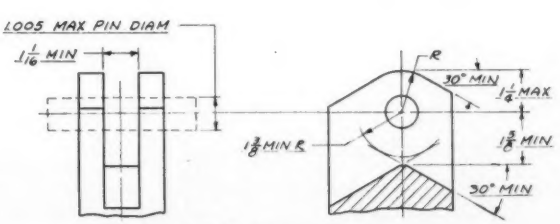


Fig. 2 Yoke clearances — rod end

to satisfactorily operate any make or model of trailing implement within the capacity of a tractor of that maximum drawbar horsepower.

2 *Both single and double-acting cylinders shall operate to raise the implements (or deangle disk harrows) on their extending stroke. Implements requiring actuating force in both directions should be operated by a double-acting cylinder.*

3 *Variable-stroke control shall be incorporated in the cylinder or hydraulic system and applied on the retracting stroke.* Variable-stroke control is considered necessary in the application of hydraulic control to some implements. Due to the forces involved, the use of stroke control or adjustable stops on implements is not recommended.

4 *Cylinder length of stroke.* 8 in — plus 1/8 in — minus 0 in

5 *Distance, center to center between attaching pins.*
Extended, 28 1/4 in — plus 1/8 in — minus 0 in

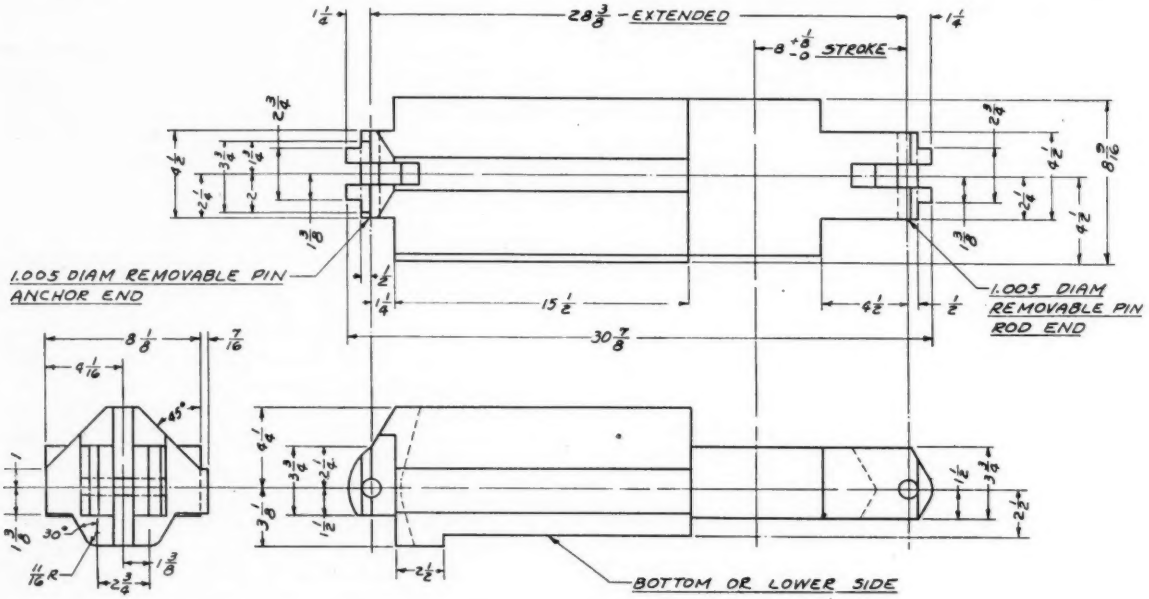
6 *Size of attaching pins.* Cylinder attaching pins shall be of 1 in nominal diameter. Oversize tolerance, 0.005 in maximum.

Implement mountings shall provide operating clearance for 1.005 in maximum diameter pins.

7 *Type of ends.* Yoke on anchor and rod ends.

8 *Width of throat.* 1 1/16 in minimum.

9 *Depth of throat.* The anchor end of the cylinder shall


28 3/8 - EXTENDED
8 +1/8 -0 STROKE
1.005 DIAM REMOVABLE PIN ANCHOR END
1.005 DIAM REMOVABLE PIN ROD END
30 7/8
15 1/2
BOTTOM OR LOWER SIDE

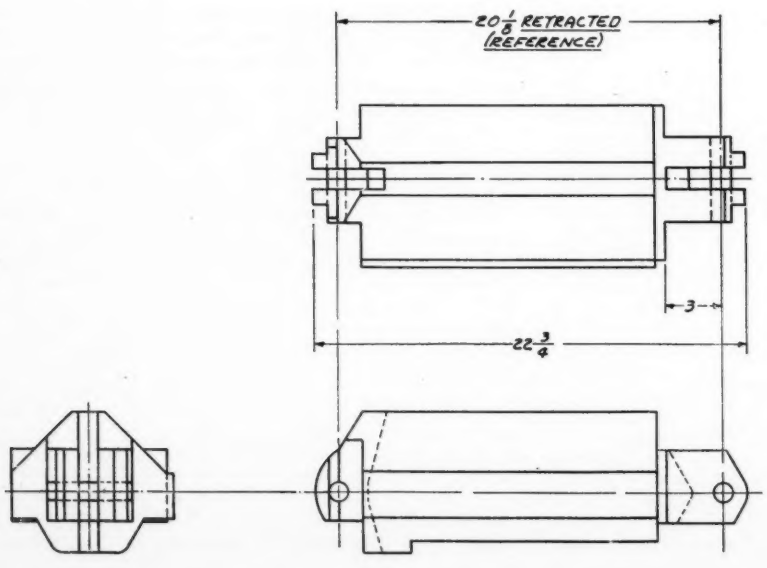


Fig. 3A *(Above)* and Fig. 3B *(Left)* Clearance model of agricultural hydraulic cylinder for farm tractors up to and including 35 dhp maximum

provide the clearance shown in Fig. 1. This affords clearance for a 1x2½-in bar through a 30 deg included angle, equally divided, and a 1x3-in bar in a perpendicular position.

The rod end of the cylinder shall provide the clearance shown in Fig. 2. This affords clearance for a 1x2½-in bar through a 60 deg included angle, equally divided, and a 1x3-in bar in a perpendicular position.

10 *Clearance Area on Implements.* Hydraulic cylinders shall operate within the composite volume specified in Fig. 3A and Fig. 3B.

Implements designed for remote-cylinder operation shall provide clearance for a cylinder of the composite volume specified in Fig. 3A and Fig. 3B.

11 *Standard Hose Lengths for Remote Hydraulic Cylinder.* The tractor manufacturer shall provide sufficient length of hose so that the hydraulic cylinder is operable when the front anchor pin is located at a maximum 60-in spherical radius from a center which is the SAE - ASAE Standard Drawbar Hitch Point (Fig. 4).

The implement manufacturer must locate the hydraulic cylinder on the implement to provide allowance for cushion spring hitches, maneuverability and turning so that the implement can be operated safely without stretching or breaking the hose under any circumstances.

12 *Hose Supports.* Support required for remote cylinder hose shall be considered as part of the implement.

13 *Hose Connections to Cylinders.* Hose connections shall be such that the hose will not interfere with bars extending through the yoke on either end of the hydraulic cylinder.

14 *Operating Time at Rated Engine Speed.* 1½ to 2 sec per 8-in stroke at rated hydraulic pressure.

15 *Provision shall be made on the implement to accommodate the full stroke of the hydraulic cylinder.*

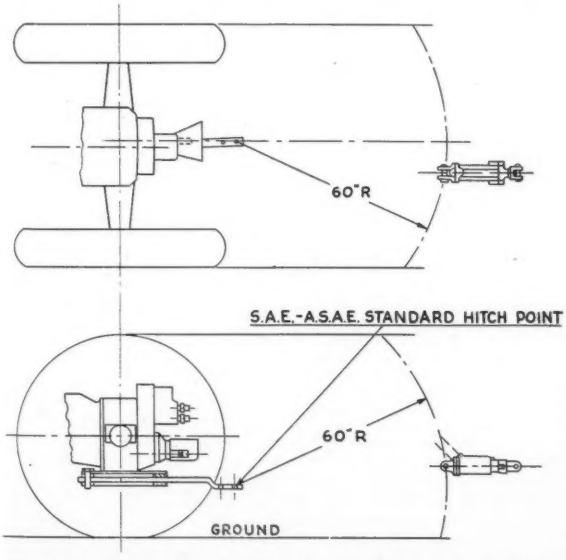


Fig. 4 The 60-in spherical radius shown is the basis for determining hose lengths for remote hydraulic cylinders

ADDITIONAL WORK CONTEMPLATED BY THE COMMITTEE

Lifting Requirements for Farm Implements. A table of lifting requirements for various types of implements was published in AGRICULTURAL ENGINEERING for August, 1946. This data was compiled from the best information available at the time, and subsequent experience has indicated it is fairly accurate. However, the power requirements were in most instances computed from indicator readings of hydraulic pressure, without adequate compensation for the varying efficiency of cylinders of different sizes and design, line losses, back pressure, and similar factors.

We now have available the load cell developed for this purpose. The operating efficiency of any hydraulic circuit may readily be determined by laboratory test. Determination of the basic lifting force by use of the load cell will enable tractor engineers, by compensation for the efficiency of the hydraulic circuit under consideration, to provide a hydraulic system of sufficient capacity to operate any implement that is likely to be used with the particular tractor under consideration.

It is the intention of the FEI Advisory Engineering Committee to carry on this work during the coming season and, when sufficient data is available, to submit a revised table of lifting requirements to the ASAE for consideration as a supplement to the above proposed standard.

Tractors over 35 dhp. Work of the West Coast subcommittee of the FEI Advisory Engineering Committee has progressed about as far as it could go pending the finalizing of the standard for tractors under 35 dhp and a more accurate method of determining lifting requirements. Use of the load cell will be extended to engineers of the various manufacturers having plants on the West Coast. We believe the experience gained by the parent committee will be helpful in carrying out the program of the West Coast subcommittee, and we are confident this part of the work will now proceed toward early completion.

A CORRECTION

THE AUTHOR, Gordon L. Nelson, calls attention to two errors in his article, entitled "Improved Designs for Farm Grain Bin Floors," appearing in AGRICULTURAL ENGINEERING for August, 1948 (vol. 29, no. 8). The two errors occur in equations in the first column on page 343. As corrected, these equations read as follows:

$$h'_1 = \frac{3m_1 - m_2}{2}$$

$$V_b = \tfrac{1}{2} R_b$$

Movement of Surface Wind

(Continued from page 13)

All lines representing wind movement for the five groups of data itemized in the body of this report and plotted in Fig. 1(a) were then adjusted to the long-time average for 1875-1930 as transposed to the airport location. In making such adjustment, consideration was given to differences in the level of wind movement for the various periods at other locations in western Kansas, namely, Tribune, Garden City, and Colby.

The following table is a summary of the adjustments (mph) made for the several groups of data:

Period	(1)	(2)	(3)	(4)
Jan. 1875-Nov. 1909	+ 5.2	+ .4	− .1	+ 5.5
Dec. 1909-Dec. 1927	+ 5.2	+ .4	+ .1	+ 5.7
Jan. 1928-Mar. 1931	+ 5.2	+ .4	+ .1	+ 5.7
Apr. 1931-May 1932	+ 2.4	+ .4		+ 2.8
June 1932-June 1942	+ 3.4	+ .4	+ .4	+ 4.2
July 1942-present	No change			

(1) Location or environmental adjustment based on long-time averages.

(2) Adjustment to allow for below-average velocities at the airport since July, 1942

(3) Adjustment for deviation of wind movement for the period from the long-time average at that location

(4) Net adjustment.

Agricultural Engineering and Professional Growth

"WHAT DO WE mean when we talk about professional growth? There are certain qualities or characteristics which are peculiar to members of a profession, and the process of acquiring these qualities may be considered as professional growth for individuals. Obviously they must be first acquired by individuals before they can become characteristic of a group.

"Engineers individually can start recognition by personally adopting a plan of activity which will develop their own aptitudes and will show forth to the public that they are professional."

The foregoing is from a statement by N. W. Dougherty, dean of engineering, University of Tennessee, on professional recognition quoted in part in the first editorial of this series in AGRICULTURAL ENGINEERING for November, 1948, page 495.

Two concrete measures of professional engineering development or stature are (1) portion of members in professions who are registered engineers and (2) educational curriculums which are accredited. A summary of these data for agricultural engineering fields follows:

This is the third of a series of four editorials sponsored by the ASAE Committee on Professional Registration — S. M. Henderson (chairman) and R. K. Frevert.

NUMBER REGISTERED AS PROFESSIONAL ENGINEERS*

State and Territory	No. reg. engrs.[1]	No. Agrl. engrs. reg.[2]	No. in a-e class[3]
Alabama	1010	1	1
Alaska†	111	0	0
Arizona	581	3	0
Arkansas	435	1	0
California	6848	15	1
Colorado	994	3	1
Connecticut	2154	3	1
Delaware	595	0	0
Florida	1067	0	0
Georgia	1824	9	5
Hawaii	265	0	0
Idaho	395	5	3
Illinois	16738	25	5
Indiana	2629	3	0
Iowa	1444	15	7
Kansas	1377	1	0
Kentucky	1468	2	1
Louisiana	746	0	0
Maine	683	0	0
Maryland	1631	2	1
Massachusetts†	3275	1	0
Michigan	3716	1	0
Minnesota	1985	6	1
Mississippi	621	2	0
Missouri	3305	2	1
Montana	315	0	0
Nebraska	904	10	5
Nevada	452	1	0
New Hampshire	210	1	0
New Jersey	4678	2	0
New Mexico	713	2	0
New York	15227	5	1
North Carolina	667	0	0
North Dakota	243	0	0
Ohio	14874	25	9
Oklahoma	1512	0	0
Oregon	1735	4	1
Pennsylvania	11504	10	1
Puerto Rico†	1173	1	0
Rhode Island	767	0	0
South Carolina	576	0	0
South Dakota†	189	0	0
Tennessee	777	0	0
Texas	6396	13	7
Utah	925	2	1
Vermont	432	1	0
Virginia†	844	2	0
Washington	2986	6	3
West Virginia	1400	1	0
Wisconsin	2217	8	0
Wyoming	286	0	0
Totals	127,899	194	56

[1]Total of all branches of engineering, as of June 30, 1948 — 39 per cent of total engineers (estimated as 50 to 60 per cent of engineers believed qualified for registration).

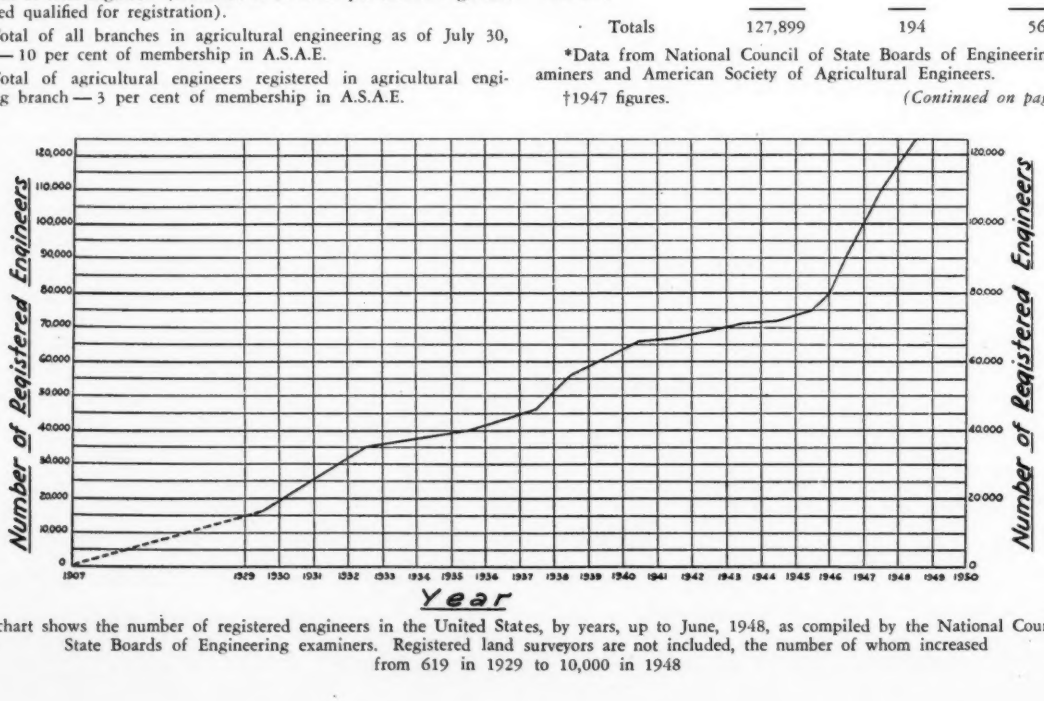
[2]Total of all branches in agricultural engineering as of July 30, 1947 — 10 per cent of membership in A.S.A.E.

[3]Total of agricultural engineers registered in agricultural engineering branch — 3 per cent of membership in A.S.A.E.

*Data from National Council of State Boards of Engineering Examiners and American Society of Agricultural Engineers.

†1947 figures.

(Continued on page 22)



This chart shows the number of registered engineers in the United States, by years, up to June, 1948, as compiled by the National Council of State Boards of Engineering examiners. Registered land surveyors are not included, the number of whom increased from 619 in 1929 to 10,000 in 1948

Grading and Seasoning of Lumber for Farm Construction

By T. K. May

WOOD AS a material of farm construction is versatile and economical. It comes in a wide variety of standard sizes, lengths, grades, and species, and is as easily purchased from neighborhood sources as a box of crackers. It is easily worked, is durable, has a pleasing appearance and "feel"; and a structure built of wood is readily altered to suit changed conditions.

To use wood to the best advantage, it is necessary to have some knowledge of how it grows, of the diversity in which it is obtainable, and the means by which it is selected for specific uses.

A tree adds to its girth each year by the addition of a ring of annual growth. Each annual ring varies throughout the growing season from large cells having thin walls, the springwood, to small cells having thick walls, the summerwood. Springwood is light in color and summerwood is dark in color.

A young tree grows rapidly, adding thick rings each year. As it grows in height and girth the annual rings must cover a greater area and become thinner. Very large, old trees have annual growth rings near the bark which are extremely thin.

Sapwood is a layer of many annual growth rings forming the outer circumference of the tree under the bark. The thickness of the sapwood layer varies with species; in some species it is 3 inches or more in thickness. Sapwood cells are living cells and transport food and water between leaves and roots.

Heartwood is the portion of the tree inside the sapwood layer. Annual rings of heartwood were formerly rings of sapwood. The cells have been filled with minerals and no longer have an active part in the life of the tree, except for support. Heartwood is darker than sapwood.

The fibers, cells, of most trees grow straight up. Infrequently the fibers coil spirally around a tree. Sometimes the spiral grows in one direction for part of the life of the tree, then straightens, and then leans backwards to spiral in the other direction. The cause of this characteristic of growth is unknown.

Each layer of annual growth covers the trunk and branches like a sheath. Branches start from the pith and as long as they are a living part of the tree, the annual growth rings over the branch are a continuation of those over the trunk. The branch at this time is intergrown. As the tree gains height and adds new branches at the top, the older, lower branches die for lack of sun. Rings of annual growth grow to the dead branch but not over it as when it was alive. Eventually the branch breaks off and as successive layers of growth are added to the trunk, the stub of the branch is finally submerged and covered. Additional layers, placed beyond the end of the stub are all clear wood. Thus are intergrown knots, incased knots, and clear wood formed.

Each of these growth characteristics just described are used in grading lumber. The relative thickness of the summerwood portion of an annual ring is a gauge of the strength because of the greater density. Rate of growth is also a measure of strength as very thin rings lack density. Sapwood is as strong as heartwood but is less durable. The sharper the slope of grain, either spiral or diagonal, the weaker the piece. (Diagonal grain results when lumber is cut straight from a tapering tree trunk). The size and location of knots is a factor in structural and other grades. The character of the knots, whether tight (intergrown) or loose (encased), is considered for appearance as well as for general use.

Lumber for many years has been standardized in sizes and grades commercially available to the average buyer. Standardization has been brought about by the establishment of American Lumber Standards of the U. S. Department of Commerce. These standards were evolved by the Central Committee on Lumber Standards with representation from manufacturers, wholesalers, and retailers of lumber, as well as from architects, engineers, and contractors as users of lumber. Virtually all regional lumber grading rules conform to American Lumber Standards. This standardization has evolved for the mutual benefit of the manufacturer, dealer, and consumer.

Lumber is sold rough or surfaced, and surfacing may be on any one side or edge or combination. The lumber usually available is surfaced on all faces. Lumber transactions are based on the rough size before surfacing. This rough size is called the "nominal size" and the unit of measure used in transactions is the foot-board-measure computed from nominal dimensions.

Selection of lumber for a specific use, other than by size, should be made by species and by grade. For decorative purposes, the texture and color of a species might be a determining factor. Durability is important when the wood is exposed to conditions conducive to decay, such as contact with the ground, condensation, and moisture. The sapwood is not rated as durable as heartwood in any species. Some West Coast species are rated for durability, under conditions favoring decay, as follows:

Western red cedar	heartwood, highly durable
Douglas fir	heartwood, durable
West Coast hemlock and Sitka spruce	heartwood, slightly durable

The durability of any species, including the sapwood of the species, is equalized and made superior to the most durable natural wood by pressure impregnating with a good preservative. Such preservatively treated wood is reasonably available.

The strength of species varies, but strength can be a confusing factor. Using Douglas fir, a wood of highest strength, as a base, some other West Coast species would approximately rate in strength as follows:

Douglas fir	100 per cent
West Coast hemlock	80 per cent
Sitka spruce	70 per cent
Western red cedar	55 per cent

However, for ordinary construction the same grade will be found available in each species with the intent that they can be interchanged in use. Though strength is a factor, the average requirements of the use are the major consideration and sufficient strength is provided to support the load. If strength alone is the prime consideration, a strength comparison can be made between two species by using a better grade of the weaker species or a larger piece.

Combinations of desirable properties will affect selections. For example, skids under a portable building would need toughness and durability. Douglas fir would provide the best combination. The sills of a modest chicken house, when resting on the ground, would require durability and Western red cedar provides the most. The stringers under a water tank, being liable to much dampness and difficult to replace, should have a very high durability and strength. For this purpose preservative pressure treated Douglas fir should be used.

The variety of grades available in lumber is a distinct economic advantage. Grades, commensurate with the quality of work being undertaken, can make an advantageous saving on a job, for the quality of the grade is a measure of the price. Therefore, an understanding of lumber grades available and their appropriate use is in order. In this discussion it seems best to avoid detailed reference to grade names, using instead a description of the quality of a grade and its use. Detailed information can be secured from grading rules and from lumber dealers.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Farm Structures Division.

T. K. MAY is director of technical service, West Coast Lumberman's Assn., Portland, Ore.

Standard cross sectional dimensions are grouped into categories which have been mostly determined by customary use. Some of these categories are: timber, dimension, plank, and boards. In timber sizes, which includes all pieces 5 inches thick and thicker, nearly all grades are selected for specific strength values. This makes it possible to determine the minimum size required to support heavy loads. Being of large size, their cost is proportionately great. It is therefore usually more economical to have major load-bearing members designed for the load they are to carry.

Dimension sizes include pieces from 2 to 5 inches thick. They are the studs, joists, and small timbers most often used in ordinary and light-frame construction. These pieces may also be had in grades selected for specific strength values and some grades are based on ordinary use without reference to a working stress. In Douglas fir dimension, there are five grades having stress values and three grades in West Coast hemlock. The principal uses of these stress grades are in trusses and similar engineered structures. It is obviously uneconomical to use the highest stress grades in conventional construction where stiffness is the prime factor. Stiffness of wood is not a measure of strength and is, therefore, not related to grade. For such buildings as machinery sheds, feed shelters, and the like, the lowest grades can be used for the frame. As a general rule, vertical members, such as studs and posts, can be at least one grade lower than horizontal load-bearing members such as joists and rafters. Consideration should be given to the fact that in ordinary framing much cutting up of pieces to short lengths is necessary. In an average house frame, about one-eighth of all the pieces are cut to less than 4 feet long. By selective cutting, much low-grade material can be raised in grade materially.

BOARD SIZES RUN TO MORE GRADES

Board sizes run to a greater number of grades than do other lumber sizes in order to provide a greater variety of uses. There are several clear grades for use as finish, stepping, flooring, ceiling, and the like. The best grade is intended for use when a clear or stained finish is desired. The next best grade is suitable when a paint finish is desired. The lower grades are most usable when they are to be cut up into short lengths, thus raising the grade.

Common boards are for use as form lumber, sheathing, subflooring, and general-purpose lumber. In using sheathing it should be remembered that though sheathing does add strength to a panel, provides a base for siding, and has insulating qualities, it is not a requisite to adequate strength. For this reason many building codes in moderate climate localities do not require sheathing; thus, a very low-grade board will economically provide the benefits derived from applying sheathing.

Wherever construction requirements are non-critical, low-grade boards can be used with satisfaction and economy. Most people would rather have a Cadillac than a Chevrolet, but economic considerations lead more people to buy the Chevrolet. The same is true in selecting lumber by grades, except that most people are not aware of the quality and uses of the lower class grades. It has been amply demonstrated, for example, that the use of too much lumber of too high a quality can add needlessly to the cost of a farm operation. Farm buildings should be built to pay dividends!

Moisture content of lumber in use is important and fiber saturation is a prime measuring point of moisture content. Fiber saturation is explained as the moisture content above which there is free water in the cell cavities and below which the remaining moisture is in the wood substance. In Douglas fir, this is about 24 per cent moisture content. It is an important moisture content level because decay will not live at less than fiber saturation and shrinkage begins at this point.

To prevent decay, lumber need only be kept at a moisture content lower than its fiber saturation. (There is an exception to this statement that should be noted. Wood that is kept continuously wet will not decay). Because of decay and shrinkage much controversial discussion has arisen as a result of the use of green lumber in building frames. To settle this point, I have made moisture content measurements on residence construction across the United States. My findings are that wood in dimension and board sizes rapidly dries to moisture equilibrium soon after the frame is completed. Moisture equilibrium is the final moisture content attained by lumber in a geographical area and according to the season. This averages from 12 to 15 per cent for exterior uses.

Condensation within a building has been found to raise the moisture content of lumber to 50 per cent. This is well above the danger point of decay. It has been noted that steel construction under similar conditions has rusted to failure. All farm buildings should be well ventilated to remove humidity created by stock or from other sources. Modern residence construction with insulation and weather stripping around openings is very susceptible to the retention of humidity with resulting condensation within the walls or under exterior paint surfaces. New paint jobs often blister from this cause. The cure, in new construction, is to put a vapor barrier seal under the inside wall finish. For existing structures, an impervious paint seal, such as aluminum paint, may be put on interior faces of exterior walls to form a vapor barrier. Areas under a structure, between the ground and first floor *must* be well ventilated and attic spaces should have adequate ventilation.

In residences or similar buildings, where swell and shrink of wood due to seasonable variations in moisture content may cause cracks in finished walls, all horizontal members at each level of construction should be of uniform depth. Thus, dimensional changes across that level of the building will be uniform and will put no stress on wall surfaces. Moisture content at time of construction, and provision for equalized swell and shrink, is not important in barns, sheds, and like buildings. Finish lumber, such as trim and flooring, should be at near moisture equilibrium for the particular construction at the time of installation. For residences, an average of 12 per cent moisture content is satisfactory.

If you were asked to describe a farm and a farm crop, it is not likely that a tree farm and trees would be thought of. Yet there are 15,211,000 acres in the United States pledged to the business of growing trees, and over each of these parcels of land, both small and large, there is proudly displayed a large sign calling attention to the fact that it is a "Tree Farm." Timber is a crop, a crop which will be harvested only once each lifetime. It is from these tree farms that the lumber for the farm houses, barns, and outbuildings of the future will be harvested.

Agricultural Engineering and Professional Growth

(Continued from page 20)

ENGINEERING DEPARTMENT ACCREDITING

Department, division or curriculums	No. of depts. in U.S.*	No. curriculums submitted for accrediting†	No. fully or provisionally accredited†	Per cent fully or provisionally accredited
Aeronautical engineering	65	24	19	29
Agricultural engineering	21	11	3	14
Architectural engineering	33	21	16	49
Ceramic engineering	14	12	11	79
Chemical engineering	109	85	54	50
Civil engineering	131	129	119	91
Electrical engineering	132	125	119	90
General engineering	29	15	8	28
Industrial engineering	44	25	18	14
Mechanical engineering	127	123	115	91
Metallurgical engineering	46	37	34	74
Mining engineering	36	39	32	89
Petroleum engineering	24	16	14	58

*From "A Guide to Colleges, Universities, and Professional Schools in the United States." Garter V. Good, editor. American Council on Education, 1945. Departments in which bachelor's degree or equivalent is offered.

†From preprint of "Sixteenth Annual Report for Year ending October 29, 1948," Engineers' Council for Professional Development.

Design Procedure for Portable Sprinkler Irrigation

By A. W. McCulloch
MEMBER A.S.A.E.

SPRINKLER irrigation is an important soil and water conservation measure in many irrigated areas. In order for this practice to become a part of the permanent agriculture in those areas, it is essential that sprinkler systems be installed on the basis of sound planning. Such planning must consider both engineering and agricultural feasibility.

To accomplish this objective, it is first necessary to establish procedures, standards, and data which can be understood and applied by people concerned with both the planning and installation of sprinkler systems.

Experience has proven that general rules of thumb and short-cut procedures cannot be applied beyond the scope of closely related conditions of climate, soils, and crop enterprises. For this reason it is necessary to understand first the basic procedures involved in good design. With this understanding, it is then possible to develop local rules of thumb, together with charts, tables, and short-cut procedures for limited climatic areas.

The procedure described here is confined to the problem of designing portable, revolving-head sprinkler systems. (See Fig. 1.) Steps in the procedure are developed in logical order. Essential features of each step are discussed and short-cut procedures suggested where applicable.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Soil and Water Division.

A. W. McCULLOCH is head, irrigation section, engineering division (Region 7), Soil Conservation Service, U. S. Department of Agriculture (Swan Island, Portland 18, Ore.)

*Superscript numbers refer to appended references.

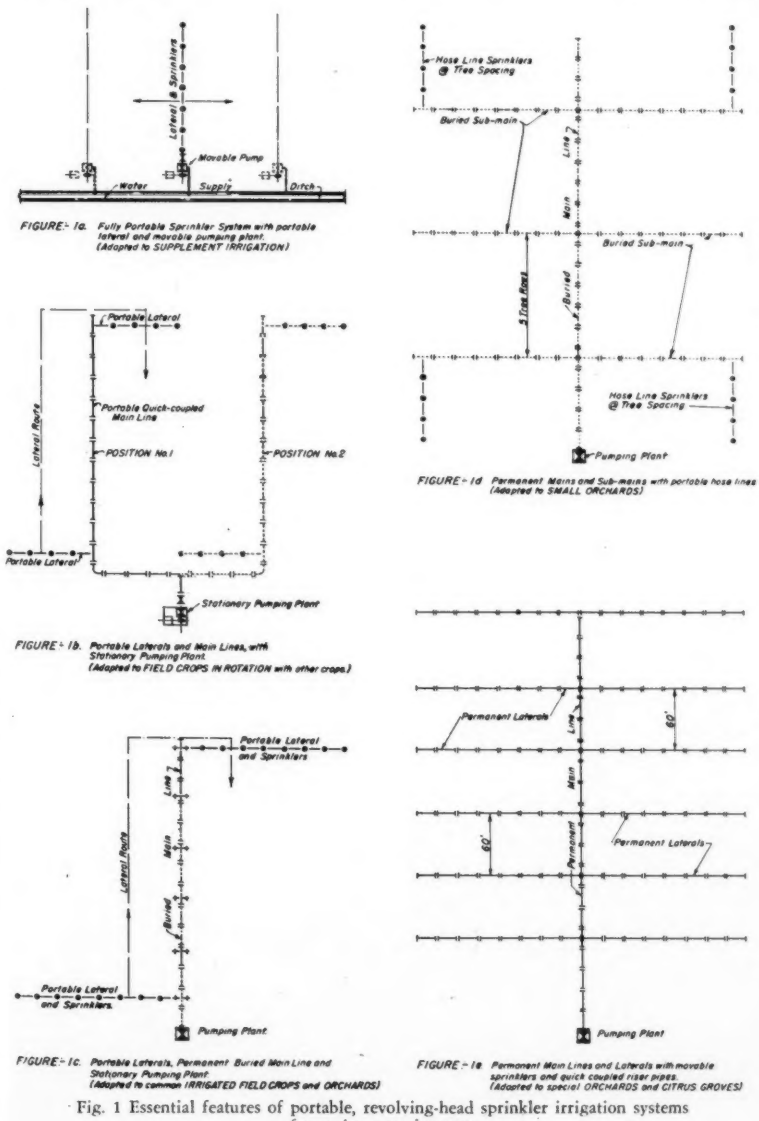

Lateral @ Sprinklers
Movable Pump
Water Supply
Ditch
FIGURE 1a. Fully Portable Sprinkler System with portable lateral and movable pumping plant. (Adapted to SUPPLEMENT IRRIGATION)
Portable Lateral
Portable Quick-coupled Main Line
POSITION No.1
POSITION No.2
Lateral Runs
Portable Lateral
Stationary Pumping Plant
FIGURE 1b. Portable Laterals and Main Lines, with Stationary Pumping Plant. (Adapted to FIELD CROPS IN ROTATION with other crops.)
Portable Lateral and Sprinklers
Line
Main
Buried
Lateral Runs
Portable Lateral and Sprinklers
Pumping Plant
FIGURE 1c. Portable Laterals, Permanent Buried Main Line and Stationary Pumping Plant. (Adapted to common IRRIGATED FIELD CROPS and ORCHARDS)
Hose Line Sprinklers @ Tree Spacing
Buried Sub-main
Line
Main
Buried Sub-main
5 Tree Rows
Buried
Hose Line Sprinklers @ Tree Spacing
Pumping Plant
FIGURE 1d Permanent Mains and Sub-mains with portable hose lines (Adapted to SMALL ORCHARDS)
Permanent Laterals
Line
60'
Main
60'
Permanent
Permanent Laterals
Pumping Plant
FIGURE 1e Permanent Main Lines and Laterals with movable sprinklers and quick coupled riser pipes. (Adapted to special ORCHARDS and CITRUS GROVES)

Fig. 1 Essential features of portable, revolving-head sprinkler irrigation systems for various requirements

Step No. 1. Make an Inventory of Available Resources and Operating Conditions. The following items should be included:

(a) Zones of different soils within the design area. Difference in soils should be based primarily on ability to retain soil moisture for plant use. Limitations in ability to take in water during the irrigation period are also to be considered.

(b) Source, quantity, and quality of available or potential water supply. (Delivery schedules and rate of delivery should be noted where water is obtained from irrigation company, district or adjudicated stream.)

(c) Available power and source.

(d) Topographic detail of design area required to determine range in operating conditions and pipe sizes.

(e) Type, acreage, and field boundaries of crops to be sprinkled.

(f) Farm operation schedules (labor, planting, cultivation, or harvest) which will affect design or operation of system.

(g) Allowable production costs for water application.

Step No. 2. Determine Amount of Water to Apply Each Irrigation. The amount of water to apply at each irrigation depends on the capacity of the soil to hold water for plant use and the pattern of moisture use by the crop in the soil profile. Allowance must also be made for a safe residual amount of soil moisture to avoid reaching wilting before water is applied.

For hay, grain, pasture, fruit, and most field row crops, the pattern of moisture use is similar for different normal root zone depths. Where the root zone is limited because of soil depth, the pattern is usually similar to that of crops having the same root zone depth. On this basis, Table 1 has been compiled for general guidance in determining the amount of water to apply to replace soil moisture used by mature crops.

TABLE 1. SOIL MOISTURE TO BE REPLACED PER IRRIGATION*

Soil texture and profile description	Total soil moisture capacity for plant use, inch per ft depth	Soil moisture to replace* per irrigation for 2, 4, and 6-ft root zone or soil depths (ac-in/ac)		
		2 ft	4 ft	6 ft
1 Coarse sandy soils, uniform in texture to 6 ft	0.50-0.75	1.0	1.75	2.5
2 Coarse sandy soils over more compact subsoils	0.75-1.0	1.5	2.0	3.0
3 Sandy loam soils uniform in texture to 6 ft	1.25-1.50	2.0	3.0	4.75
4 Sandy loam soils over more compact subsoils	1.25-1.75	2.25	3.25	5.0
5 Silt loam soils uniform in texture to 6 ft	1.75-2.25	3.0	4.0	6.5
6 Silt loam soils over more compact subsoils	2.00-2.25	3.25	4.25	6.75
7 Heavy-textured clay or clay loam soils	1.8 -2.0	2.5	3.25	5.5

* At 100 per cent efficiency.

These values must be divided by the estimated water-application efficiency to obtain the gross amount to apply.

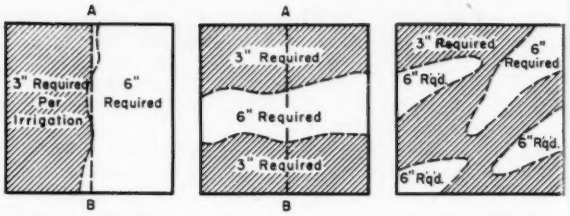


Fig. 2 Left: In this case, the design area can be subdivided by a main (A-B) and either one lateral operated for both sides, but run twice as long on the 6-in zone and twice as often on the 3-in zone, or separate laterals designed with different water-application rates. In either case the frequency of irrigation would be two times on the 3-in zone for each time on the 6-in zone • *Center*: In this case, the system can be designed as for a uniform soil area using the 3-in water-application rate. In operation the lateral or laterals would be operated twice as long on the 6-in zone during the early growing season, but the entire area irrigated by the frequency required for the 3-in zone during peak moisture use periods • *Right*: In this case, again the system would be designed for the 3-in zone. For deep-rooted crops, the area might be given a 6-in application over the entire area for the first irrigation in the spring. This would mean some sacrifice in water-application efficiency, however

In the case of potatoes and some special crops, it may be necessary to maintain higher moisture levels in the root zone in order to obtain best quality or optimum yields. In such cases, the values in Table 1 are reduced to allow for higher soil-moisture levels when water is applied.

To determine the gross amount of water required for each irrigation, the efficiency of water application of the system must be considered. In arriving at a figure for irrigation, efficiency, the planner should consider the following:

(a) Per cent of water applied lost to interception and evaporation. Maximum daytime temperatures, relative humidity, and wind movement will determine these losses. The rate of application by the sprinklers is a very important factor in arriving at the losses which will occur.

(b) Uniformity of water distribution in the sprinkler spacing pattern. For good design, the sprinkler nozzle, operating pressure, and line and lateral spacing should be selected to limit variation in moisture distribution to 20 per cent or less.

When the design area has soil zones which have significantly different values for moisture replacement, consideration should be given to subdivision of the design area on the basis of difference in the amount to apply each irrigation. Fig 2 illustrates some examples of how this problem may be handled.

Step No. 3. Determine Peak Use Frequency of Irrigation or Shortest Irrigation Period. The sprinkler system must have the capacity to replace the moisture used by the crop during periods of peak use and allow for losses in efficiency of water appplication.

On this basis, the frequency of irrigation will depend on how long the water added to the soil and stored there for plant use will last when the crop is transpiring at the maximum rate. For example, suppose that alfalfa used moisture during July at the rate of 0.20 acre-inches per acre per day, and the amount of water replaced in the soil type given was 4.0 acre-inches per acre for each irrigation. Then the frequency of irrigation is 4.0/0.2, or 20 days.

Peak use rates for different crops can be compiled for fairly broad climatic zones. Values for climatic zones in the western states are given in Table 2.

When more than one type of crop is planned in the de-

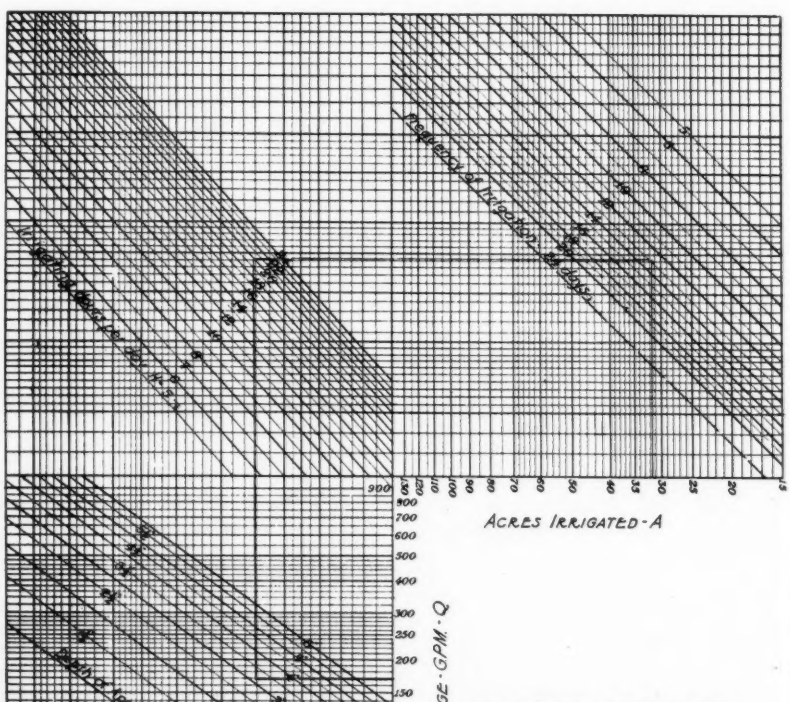


Fig. 3 An acreage-discharge chart

sign area, peak use frequencies and the period when each occurs must be considered. Usually the system is designed to get over the design area in approximately the same period as represented by the peak-use frequency.

Other factors may be involved, however, which make it necessary to cover the design area in a period less than the irrigation frequency period. Such factors may include:

(a) Delivery or rotation schedules of irrigation enterprises.

TABLE 2. VALUES OF PEAK DAILY USE OF SOIL MOISTURE (ACRE-INCHES PER ACRE PER DAY) FOR COMMON IRRIGATED CROPS AND OPTIMUM YIELDS

Crop	Cool climate	Moderate climate	Hot climate
Alfalfa	0.15	0.20	0.25-0.30
Pasture	0.12	0.16	0.20-0.25
Grain	0.15	0.20	0.22
Potatoes	0.10	0.12	0.14
Beets	0.12	0.15	0.20
Deciduous Orchard	0.15	0.20	0.25
Orchard with cover crop	0.20	0.25	0.30

(b) Harvesting operations. In this case it may be necessary to apply the water during a relatively short period in order to permit harvesting operations to start. In the case of hay, it may be desirable to irrigate immediately after haying, thus requiring coverage of the area in a short period.

(c) Special application of water for quality as in the case of truck crops for canning or freezing.

Step No. 4. Determine Capacity Requirements of the System. The capacity of the system required to serve the design area is determined by the following:

a Acreage of the design area.
b Amount of water to be applied (including losses).
c Net operating time allowed to apply required water.

The capacity of the system in gallons per minute can be computed by the formula, $Q=453\,Ad/FH$, where Q is discharge in gallons per minute, A is acreage of design area, d is the gross depth of water application in acre-inches per acre, F is the number of days permitted for operation, and H is the average number of hours of operation per day.

An acreage-discharge chart (Fig. 3) may be used to make these calculations conveniently.

For local areas, where the peak-use rates of different crops have been compiled and the average water-application efficiency can be assumed, the capacity requirements can be expressed as gallons per minute required per acre. This figure represents the capacity if the system is operating continuously.

For example, assume that alfalfa uses 0.2 in. per day during July, and the average efficiency of sprinklers is assumed to be 70 per cent. Then the capacity requirements for continuous operation is $Q=(0.2 \times 18.7)/0.70=$ 5.35 gpm per acre (18.7 gpm required to apply one acre-inch per acre per day). The gpm value obtained for each crop must be corrected for the operating time factor, which is the ratio of the actual time operated to continuous operating time. For example, if the irrigation-frequency period was 10 days and the system is operated 14 hr a day for 5 days, then the capacity requirements per acre would be $q=5.35\times(24/14)\times(10/5)=18.4$ gpm/acre.

Step No. 5. Determine the Optimum Water-Application Rate. The rate at which water is applied in terms of inches per hour (or acre-inches per acre hour) depends on the following factors:

(a) Maximum rate of intake of water for the conditions of soil, slope, and cover.

(b) Minimum rate of application for satisfactory efficiency for climatic and wind conditions.

(c) Desirable time to apply required amount of water considering efficient labor schedules or other operations of the farm.

(d) Rate adjusted to number of sprinklers operating with best suited layout of lateral settings.

In all cases, the water-application rate must fall somewhere between maximum and minimum values. Table 3 sets forth suggested values for maximum water-application rates for different soil slope and cover conditions. These values are necessarily

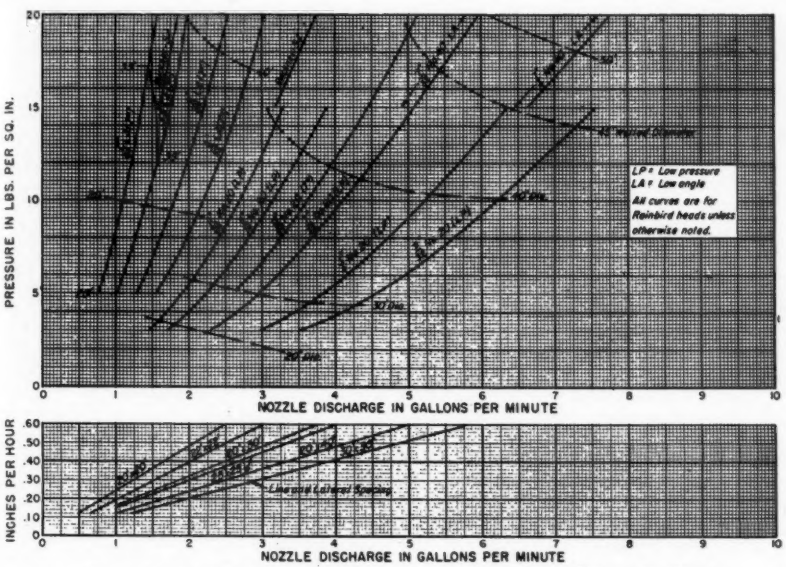


Fig. 4 Low-pressure undertree hose line or portable sprinkler data under 20 psi

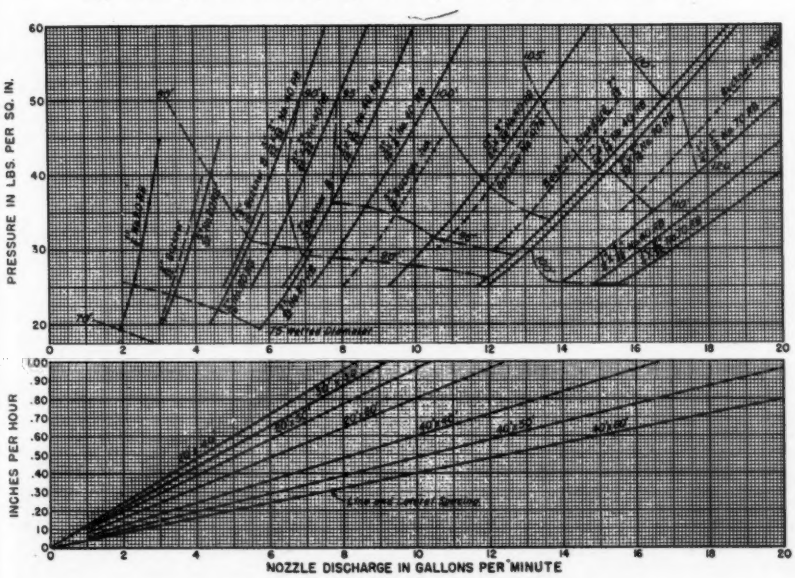


Fig. 5 Moderate to high-pressure sprinkler data over 20 psi

general and should be made more specific for local conditions.

Table 4 gives values for minimum water-application rates for broad climatic zones. These values were determined primarily from observation of conditions in the West. There is a definite need for more study in determining the actual values of loss due to evaporation and wind drift.

Between maximum and minimum rates of application, the designer should consider the rate which will require a time of setting which will most nearly fit with the farm-operation schedules of each farm. For small units, it is usually desirable to have time-of-setting intervals which give, one, two, or three changes per day, and which avoid after-dark changes.

Step No. 6. Determine Line and Lateral Spacing, Sprinkler Discharge, and Operating Pressure Required. In order to determine the requirements of line and lateral spacing, the operation conditions as revealed in the inventory, Step No. 1, must be interpreted and understood. This is especially important where gravity pressure is to be utilized. In this case, the operating pressure may be fairly well fixed unless a booster pump is contemplated. In orchard or citrus irrigation, the decision as to whether overtree or undertree systems are to be used must be made, which in turn will govern spacing requirements.

Each type of sprinkler has certain pattern characteristics which change as nozzle size and operating pressure change. For each type of sprinkler head, there is an optimum range of operating pressures for each nozzle size. This information should be made available to planners by sprinkler manufacturers.

Wind velocities will materially change the pattern and diameter of coverage. In some areas, it is important to allow for this by reducing the lateral spacing or by using triangular rather than rectangular spacing arrangement.

A number of men interested in sprinkler irrigation have investigated these problems, including Christiansen[1]*, Wilcox[2], Bowman and McCulloch[3], and others. There is a need for a full summary of these studies and for additional work to determine the optimum line and lateral spacings together with the optimum operating pressures for each nozzle size.

Figs. 4 and 5 have been compiled from data obtained from two leading sprinkler manufacturers. Using the general rule of limiting line or lateral spacing to 0.7 of the diameter of coverage, these charts can be used to select the best combination of spacing, nozzle discharge, nozzle size, and operating pressure.

High-pressure sprinklers are now coming into use. It should be kept in mind that the power cost to apply water bears a direct relationship to the operating pressure. Saving in labor or improvement of crop quality has to offset the additional cost to pump against pressures of higher magnitude.

Step No. 7. Determine Optimum Number of Sprinklers to Operate Simultaneously. From Step No. 6 the approximate sprinkler-head discharge is determined which will meet the requirements for optimum water-application rate, operating pressure, and sprinkler spacing. Divide the value in gpm into the total system capacity requirements determined in Step No. 4. This figure for the number of operating sprinklers provides an important guide in arriving at the required layout of main line and laterals in the next step. It should be understood that this value is tentative and will usually need to be modified to fit the layout finally selected.

Step No. 8. Determine Best Layout of Line and Laterals. There is a wide opportunity for individual judgment in this step and the three subsequent steps which follow. There are some general rules for good layout which should be kept in mind. These rules are as follows:

(a) Main lines should be laid down predominant land slopes.

(b) Laterals should be laid across slope or as nearly on the level as possible to minimize pressure variation.

(c) Changes in pipe size for pressure control should be made on main lines in so far as is possible.

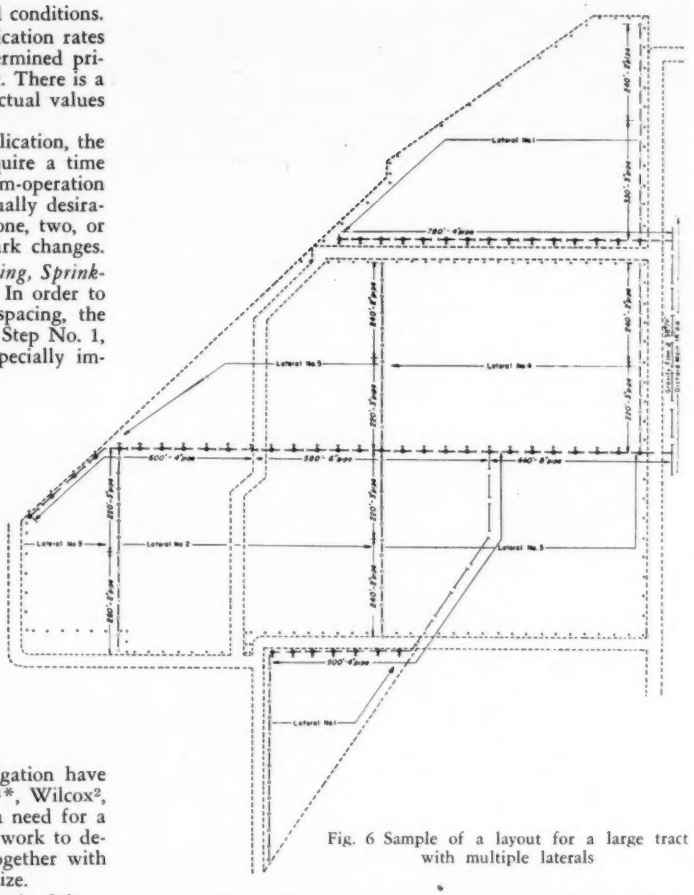


Fig. 6 Sample of a layout for a large tract with multiple laterals

(d) For multiple lateral operation, laterals should be limited to one or not more than two different pipe sizes.

(e) If a choice of water supply sources is possible, the location nearest to the center of the design area will result in the most economical combination of pipe sizes.

(f) Split-line operation with 2, 4, 6, etc., laterals operating at the same time is desirable for larger design areas.

(g) Layout should facilitate rotation of multiple later-

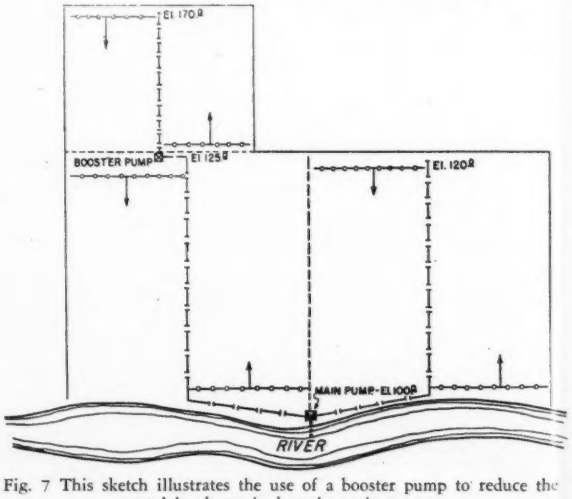


Fig. 7 This sketch illustrates the use of a booster pump to reduce the total head required at the main pump

TABLE 3. SUGGESTED MAXIMUM WATER APPLICATION RATES FOR SPRINKLERS FOR AVERAGE SOIL, SLOPE, AND CULTURAL CONDITIONS

Soil and texture and profile conditions	Maximum water application rate, inches per hour for slope and cultural conditions							
	0-5% slope		5-8% slope		8-12% slope		12% and over	
	Cover	Bare	Cover	Bare	Cover	Bare	Cover	Bare
2 Coarse sandy surface soil over more compact subsoils	2.0	2.0	2.0	1.5	1.5	1.0	1.0	0.5
2 Coarse sandy surface soil over more compact subsoils	1.75	1.50	1.25	1.0	1.00	0.75	0.75	0.4
3 Light sandy loams uniform in texture to 6 ft	1.75	1.0	1.25	0.8	1.00	0.6	0.75	0.4
4 Light sandy loams over more compact subsoils	1.25	0.75	1.00	0.5	0.75	0.4	0.5	0.3
5 Silt loams uniform in texture to 6 ft	1.0	0.50	0.8	0.40	0.6	0.30	0.4	0.2
6 Silt loams over more compact subsoil	0.6	0.3	0.5	0.25	0.4	0.15	0.3	0.10
7 Heavy-textured clays or clay loams	6.0	0.15	0.15	0.10	0.08	0.12	0.10	0.06

*Summary from Section 2, Chapter VI, Regional Engineering Hand-book, Soil Conservation Service, Region VII.

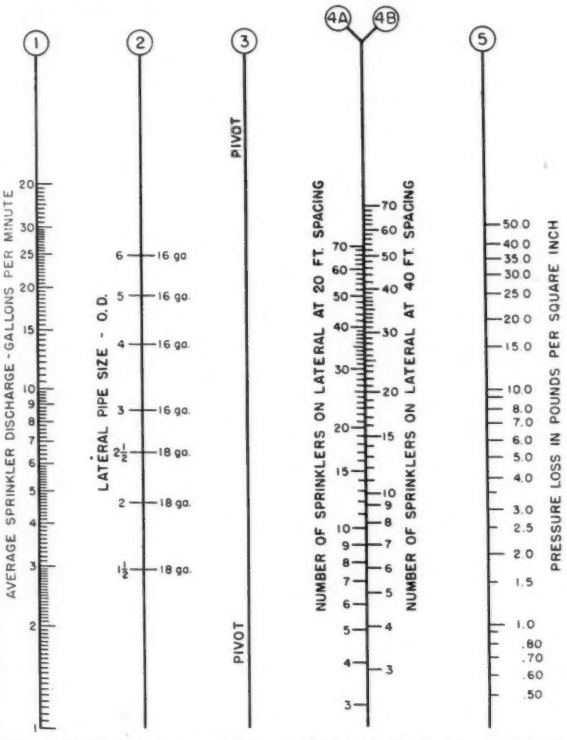


Fig. 8 Pressure loss in portable sprinkler laterals, based on Scobey's formula with values of K_n and multiple-outlet factors as recommended by J. E. Christiansen (Irrigation by Sprinkling, Bulletin 670 (Fig. 26), University of California)

PROCEDURE: To find lateral size or combination of lateral sizes which will result in 10% or less variation in sprinkler discharge

Given: (a) Average sprinkler discharge for all sprinklers on the lateral, (b) average operating pressure required, and (c) number of sprinklers on lateral

Step No. 1: Compute 20% of average pressure (b) and locate on scale 5

Step No. 2: Find number of sprinklers on lateral or scale 4A for 20-ft spacing, or 4B for 40-ft spacing. Connect points on scales 5 and 4A or 4B and extend to scale 3 (Pivot line)

For spacing other than 20 or 40 ft, use the following procedure:

(a) Compute 20% of average operating pressure

(b) Multiply value obtained by 20/spacing and then use the value obtained to start on scale 5

(c) Follow steps No. 2 to 4 using scale 4A. If lateral of known size is to be analyzed for pressure loss, use scale 4A and then multiply value obtained on scale 5 by spacing/20.

Step No. 3: Connect point on scale 3 with value for average sprinkler discharge on scale 1

Step No. 4: Read on scale 2 the lateral size required. If the line connecting scales 1 and 3 intersects scale 2 between two pipe sizes, the approximate proportion of the two sizes may be determined by estimating the proportional inverse distances between the point of intersection and the pipe size point on the scale.

als to avoid long hauls of laterals back to starting position (Fig. 6)

(h) The difference in the number of sprinklers operating on odd-shaped tracts should be held to a minimum.

(i) Total variation in pressure on laterals should be held to 20 per cent or less.

(j) All pipe sizes should be selected on the basis of favorable balance between annual amortized cost of pipe compared with annual power costs.

(k) Booster pumps should be considered for small parts of the design area to avoid carrying high pressures from the main pumping plant for relatively small fractions of the total discharge (Fig.7).

(l) Layouts should consider broad soil zones as discussed under Step No. 2.

The above rules will only provide general guidance to the planner. In many cases, the layout will be simple, as in the case of regular-shaped areas. On the other hand, large odd-shaped tracts may develop into a full-scale engineering problem, requiring alternate layouts and careful economic pipe size analysis.

Step No. 9. Adjust Sprinkler Discharge and Operating Pressure to Meet Layout Requirements. With the layout of laterals and main lines completed, it will usually be found that the number of sprinklers operating simultaneously is more or less than the optimum number determined in Step No. 7. In this case, the number of sprinklers is divided into the total discharge requirements to determine the required discharge of the individual sprinkler. In turn it may be necessary to change the nozzle size and operating pressure to give the required discharge. If the final resulting water-application rate is different than the determined optimum rate, it may be necessary either to change the operating period or go back and redesign the layout in an attempt to adjust the number of operating sprinklers.

Step No. 10. Design the Sprinkler Lateral. Actually this step may be combined with the layout in order to check the limiting length of laterals for practical lateral pipe sizes. Sprinkler laterals should be designed to limit total variation in sprinkler discharge along the lateral to 10 to 15 per cent. This means that variation in pressure should be limited to 20 to 30 per cent. Where laterals are laid downslope, it may be expedient to use laterals with greater variation, and depend on manually operated valves at points on the line to control pressure.

Fig. 8 has been compiled from charts developed by Christiansen[1]. This nomograph makes it possible to determine required pipe size without the usual trial-and-error procedure.

Step No. 11. Design the Main Lines. Main lines serving sprinkler laterals must have the capacity to deliver the re-

TABLE 4. SUGGESTED MINIMUM WATER-APPLICATION RATES FOR CLIMATIC CONDITIONS IN WESTERN STATES

Climatic Zone	Recommended minimum rate, inches per hour	
	Undertree orchard	Overhead or field crops
North Coastal (Wash., Ore.)	0.10	0.12
South Coastal (Calif.)	0.12	0.15
North Interior Valleys (Wash., Ore.)	0.15	0.18
South Interior Valleys (Central Valley & Santa Anna River, Cal.)	0.20	0.25
Northern Desert (Ore., Ida., Nev.)	0.30	0.40*
Southern Desert (Calif., So. Nev.)	0.50*	0.75*

*Evaporation and drift losses increased because of dry wind movement.

quired quantity of water to all lateral setting positions with sufficient head to provide the required operating pressure and to overcome all friction losses in both main line and laterals. Appropriate tables, charts, or nomographs are available in pipe handbooks to determine friction losses.

Step No. 12. Check Pipe Sizes Selected for Economic Design. The relationship of pipe size, pressure variation, and power requirements must be kept in mind in designing a sprinkler system. The problem revolves itself into two primary considerations:

(a) Where gravity pressure is utilized.
(b) Where pressure is furnished by pumping.

In the first instance, main line pipe sizes are designed to the minimum combination of sizes which will still deliver the required discharge to the laterals with the required operating pressure. In turn the laterals are designed for the smallest pipe sizes which will result in not more than 20 per cent variation in operating pressure for all sprinklers on the lateral.

Where pressure is furnished by pumping, the problem becomes one of balancing the annual cost of larger pipe sizes with the annual value of saved power resulting from reduced pressure losses. Several approaches to this problem have been used in the past. One approach is to make an individual analysis for each installation. This is a tedious process and time consuming.

Another method proposed is to set down in the form of an integral equation all factors entering into the cost analysis and then to differentiate to determine what pipe size will result in minimum annual cost.[4]

The author suggests still another method of checking economic pipe size. Charts can be compiled, based on local power rates, giving the annual cost of pumping for different horsepower requirements and for different total hours of operation or seasonal quantity of water. Fig. 9 is an example of such a chart, based in this case on power costs in central California.

Either charts or tables can also be compiled to give the annual amortized cost difference for the length of pipe considered, based on the initial cost difference between pipe sizes. Fig. 10 is a sample of such a chart compiled for pipe having an expected life of 20 years.

With such information, the horsepower requirements for each pipe size compared can be computed, the annual cost difference in power obtained from the first chart, and this value compared with the amortized pipe cost difference in the second chart.

Step No. 13. Selection of Proper Pumping Facilities. It is very important that the proper pump and motor be selected to meet all operating conditions imposed by the sprinkler system. There is a definite need for a well-illustrated manual on this subject to aid designers and dealers in making the proper selection.

Step No. 14. Check on Annual Water-Application Costs. It is important that sprinkler systems be designed on a sound economic basis in order that the practice become a permanent feature of using the land for which they are designed.

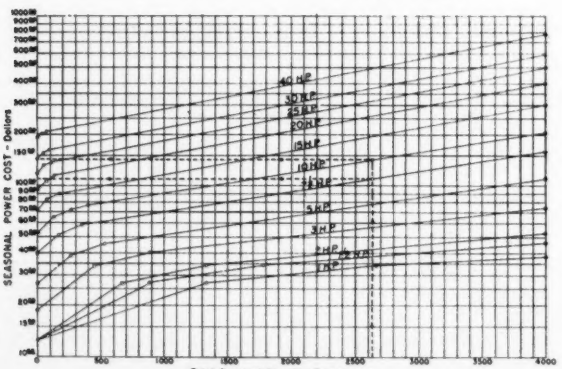


Fig. 9 A sample chart of annual power costs

The final determination as to whether sprinkling is feasible over a long period of time is almost an individual farm-by-farm determination. However, in areas of similar agricultural enterprises certain broad determinations can be made as to sprinkler feasibility.

In arriving at this determination, it is important to finally compare both sides of the ledger on an annual basis. To bring out the features involved in determining the feasibility of sprinklers, these items are tabulated in ledger style as follows:

FACTORS INVOLVED IN COMPARING ANNUAL WATER COSTS

Fixed Charges	Charges against sprinklers	Benefits to balance costs
1 Annual cost of water delivered to farm	1 Annual repayment and interest charges for installing system, or	1 Reduction on fixed water costs by savings in water use
	1a Annual sum required to amortize the cost of the system. 15 to 20 years	2 Net value of crop yield increases because of better water application.
	2 Annual power costs to operate the system	3 Reduced annual costs of land preparation, (floating, leveling, etc.)
	3 Annual repair and replacement costs	4 Reduced cost of irrigating labor
	4 Increase in irrigating labor costs*	5 Eliminated cost of furrowing
	5 Increase in cost of spray program*.	6 Eliminated cost of ditch maintenance, replacement of spiles and other surface irrigation structures.
	* Special Cases.	7 Eliminated erosion value

Step No. 15. Prepare Plans, Schedules, and Instructions for Proper Installation and Operation of the System by User. It is the author's opinion that this is the most important feature of sprinkler irrigation planning. The user should understand specifically what the operating pressures are and how much they can vary. He needs to know how to move his laterals to best advantage, including the rotation of multiple laterals. He should be carefully instructed on how much water his soils will hold, in terms of how long he needs to run a lateral in one setting. He should also have a guide as to how to tell when to start irrigating, based on soil moisture conditions.

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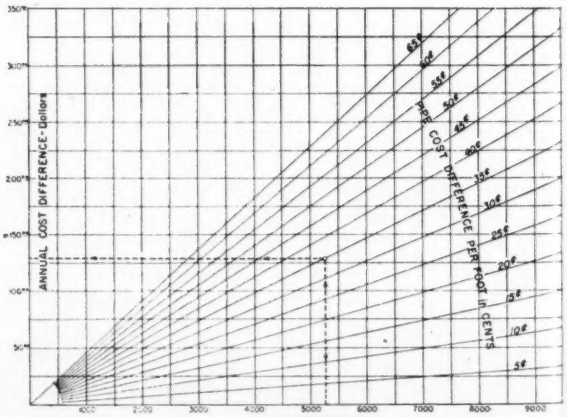

Fig. 10 Annual cost difference for pipe with 20-year life

New Developments in Poultry and Dairy Barn Ventilating Equipment

By Nolan Mitchell
Junior Member A.S.A.E.

FOR MANY years farmers in the colder climates of our country have been plagued by ventilating problems in their livestock buildings. To most farmers ventilation is a mystery, and as a result they have given it very little attention. In many cases the primary objective has been to construct the building so that it will be warm for both animals and men during the cold winter months. They have made the buildings tight, and in many cases have insulated them to accomplish this objective. In so doing they have solved one problem and created another — the lack of adequate ventilation.

This problem results in tremendous financial loss to farmers through sickness and death of animals, decreased production of livestock products, and deterioration of buildings. Present-day technology developed through research and practical experience, though not perfect, makes it possible to improve this situation greatly.

The primary purpose of this paper is to discuss present-day ventilation equipment and methods. However, it is deemed desirable to state briefly the job that a satisfactory ventilation system must perform. A successful ventilating system for any livestock building must (1) continuously supply the animals with an adequate supply of fresh air and (2) remove from the building the moisture and odors given off by the animals. It must distribute the incoming air evenly throughout the building without creating drafts. These functions must be performed so as to maintain the proper temperature and relative humidity. Obviously the duty of ventilation equipment varies with the type of livestock housed. Therefore, the ventilation of dairy barns and poultry houses will be treated separately.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Rural Electric Division.

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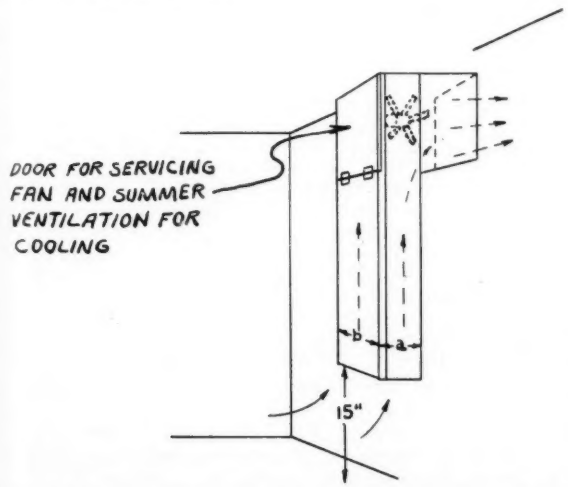


Fig. 1 Ventilation outtake or exhaust duct. The dimensions ("a" and "b") should be such that the proper area of the duct is maintained and dimension "a" is not made less than one-half that of "b". The duct should be as nearly square as conditions will permit

DAIRY BARN VENTILATION

Such noted investigators and authors as Strahan[1]*, Fairbanks[2], Goodman[2], Armsby[3], Kelley[4], and others have very ably determined and presented valuable data that can be used as a basis for the design of dairy barn ventilation systems.

Fresh Air Needed. A 1000-lb cow inhales about 116 cu ft of air per hour or more than 200 lb per day. This is more than the combined weight of feed and water that she eats and drinks — 50 lb of feed and 100 lb of water. Air exhaled is high in moisture and low in oxygen content. Such air if inhaled again is not healthy for cow or man. If a cow is forced to breathe air over and over again, she becomes sluggish and eats and drinks less with a consequent reduction in milk production. It has been stated that the percentage of once-breathed air in a stable should not exceed 3.3 per cent. In barns where approximately 600 cu ft of air space is provided per cow, about 3600 cu ft of air per hour, or 60 cfm per cow, is required to obtain this degree of dilution.

Moisture to be Removed. An average 1000-lb cow will exhale about 16 lb of water per day. This water in addition to that evaporated from the gutters and washed floors of the stall, which we may assume to be about 4 lb, must be removed from the barn. If not, it will raise the relative humidity of the air to an undesirable point, creating an unhealthful condition for the cows, and water will condense on the doors, windows, walls, ceiling, and under side of the roof. In many instances the moisture which condenses on the under side of the roof drips back on the hay and spoils considerable quantities of home-grown feed.

A psychrometric analysis shows that when the inside air is maintained at 40 F and 75 per cent relative humidity with an outside air temperature of 0 F and a relative humidity of 90 per cent, 60 cfm will remove 20.8 lb of water from the barn in 24 hr.

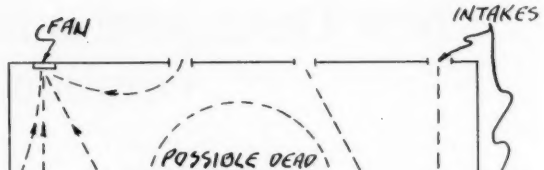
If the outside temperature increases to 40 F with a relative humidity of 85 per cent and the inside temperature increases to 50 F and the relative humidity to 80 per cent, it is found that 60 cfm of air will remove only 11 lb of water which is not enough. However, if the inside temperature is allowed to increase to 60 F and the relative humidity to 80 per cent, which it will probably do with this rate of air flow, 60 cfm will remove 28 lb of water every 24 hr. Thus it appear that 60 cfm of air per 1000-lb cow is sufficient to remove the moisture.

Temperature and Relative Humidity. There appears to be no agreement on the optimum temperature that should be maintained. A study of several reports indicates that a minimum temperature of 40 F is satisfactory. However, some dairymen prefer 50 F as a minimum. It is generally agreed that a maximum relative humidity of from 75 to 80 per cent is satisfactory.

Experience has shown that in ventilating the average dairy barn the conservation of heat during cold weather is a much greater problem than the removal of excessive heat during mild weather, and consequently more attention has been given to it. A 1000-lb cow gives off on the average 2800 Btu of sensible heat per hour. This heat is available for warming the air and evaporating water. In addition she gives off an average of 400 Btu of latent heat per hour in the form of water vapor. In calculating the insulation required, only the sensible heat should be considered. This amount of heat is sufficient to keep 600 cu ft of space with a wall exposure of 135 sq ft at a comfortable temperature when adequately ventilated, if the walls have a reasonable amount of heat resist-

*Superscript numbers refer to appended references.

Fig. 2 Proper method of locating one or more fans in relation to intakes to obtain movement of fresh air throughout the entire area



Flg. 3 Separation of fans when two or more are used in one compartment may result in dead air spaces or areas of eddying currents

ance. The required heat resistance or insulation value of the wall will of course depend on the amount of air used, the outside temperature and the inside temperature to be maintained.

Experience has shown that a wall consisting of two 1-in boards with building paper between, or its equivalent, is satisfactory in most areas. In two-story barns with a hay mow above the stable, the ceiling insulation is not much of a problem, provided a layer of hay at least one foot deep is left on the mow floor above the stable. Where no hay is stored above the stable, the ceiling should be insulated. The amount of insulation needed for any area can be calculated by use of standard heat transfer formulas.

Summary of Air Requirements. It appears that an air flow of 60 cfm per 1000-lb cow is sufficient to supply the cows with fresh air needed and to remove the excessive moisture. This has been confirmed by field experience. Many systems are performing satisfactorily with a constant air flow of 60 cfm per 1000-lb cow. It has been found that at times during mild weather it is desirable to use approximately 80 cfm with provision for reducing the flow during cold weather or when the stable temperature drops below that desired.

Types of Ventilating Systems in Use. At present there are numerous makes of ventilation equipment available. This equipment may be divided into three general classifications based on the methods or system of handling air. There are slight variations within each classification.

The system employed by one group of manufacturers consists of exhausting the air from near the ceiling and bringing fresh air in at the ceiling level. Some in the group exhaust the air from the center of the barn with intakes arranged to bring fresh air in around the outside walls. Others have the exhaust fans in the walls of the barn with intakes located in the ceiling through the center of the barn.

The method used by another group is to exhaust the air from near the floor and bring fresh air in at the ceiling level. There are two variations in the method used by this group. In some cases the air is brought in through intakes located in the sidewalls of the stable, and in others the air is taken from the mow through a duct built between the rafters and floor joists letting it into the stable through ceiling intakes located along the center of the stable.

The third group uses an exhaust fan mounted in the barn wall to exhaust the air from near the ceiling. No intakes are used. The air is allowed to enter the barn through cracks in the walls, around doors, windows or whereever there is an opening.

Each of these three general methods have strong advocates, and no doubt any of them can be used successfully. However, it is believed that some of the methods are more dependent on proper barn construction and insulation than others.

So far as is known no conclusive comparative tests have been completed to determine whether it is better to exhaust the air from the floor level or from the ceiling level. Such tests are now under way or being planned, and no doubt before long more information on this subject will be available.

When our company entered the farm ventilation field a decision had to be made on the method of ventilation to be used. A study was made of all the information on the subject that could be secured. This study revealed that most investigators agreed that the fresh air should be brought in at the ceiling, but that there was no agreement as to whether the exhausted air should be removed from the floor or ceiling level. It was noted that the air near the floor was in many cases as much as 10 F cooler than that near the ceiling. Since it was evident that the conservation of heat was one of the problems involved, it seemed logical that the coolest air in the stable should be exhausted. Using this logic and our experience in commercial and industrial ventilation, the decision was made to use that principle. Our methods are based largely on the work done by Fairbanks and Goodman[2] of Cornell University. The results have been quite satisfactory even under adverse conditions.

Briefly, the system consists of one outtake or exhaust duct that removes cool moist air from near the floor and small intakes evenly spaced around the walls, each of which lets a low-velocity stream of cold, fresh air in at the ceiling where it mixes with the warm air and is warmed before it reaches the cows.

The exhaust duct is equipped with a fan or fans to provide the required amount of positive ventilation at all times. The fan is usually mounted in a hole cut in the wall of the barn near the ceiling of the stable. It may be mounted in a plywood panel which may be located in a window. A square or rectangular duct is built around the fan extending down to within 15 in of the floor. The cross sectional area of the exhaust duct depends on the air delivered by the fan. It should provide for an air velocity not to exceed 700 fpm. In the exhaust duct back of the fan a removable panel or hinged door is provided that may be opened for servicing the fan and used for summer ventilation (See Fig. 1).

We offer two types of systems designated as a one-fan system and a two or twin-fan system.

The *one-fan system* is recommended only for well-built and insulated barns with a constant load of cows and 600 cu ft of air space or less per 1000-lb cow. The fan should have a capacity of 60 cfm per cow and should operate continuously without automatic control. Under such conditions the one-fan system will do a satisfactory job.

The *two-fan system* is highly recommended for the following conditions:

1 For poorly constructed or insufficiently insulated barns
2 When the number of cows housed varies considerably during the ventilating season
3 For stables with an air space of more than 600 cu ft per cow
4 Where additional ventilation is desired during mild weather.

The combined capacity of the two fans should be 80 cfm per 1000-lb cow. Each fan should deliver one-half of this volume. One of the fans is controlled by a thermostat set to turn it off when the desired minimum temperature is reached. This fan is equipped with an automatic shutter to prevent air from entering the exhaust duct through it when it is not operating. The other fan runs continuously and provides some ventilation at all times.

If possible, the fan should be located away from the prevailing winds. In barns up to 50 or 60 ft in length the fan and exhaust duct may be located in either side or end. In longer barns they should be located in the center of one side. In L-shaped barns the fan should be located near the angle.

In some dairy stables there are areas which tend to be cold because they house young stock or mature animals in pens. Most dairymen want to locate the fan in such areas and pull some heat into it from the warmer areas of the stable. This can be done satisfactorily provided certain precautions are taken. The heat resistance of the walls enclosing these areas must be high enough to prevent the warm air from the warmer areas from cooling to the dew point. Otherwise, moisture will condense and create a wet, soggy condition. If the ventilation system is first put into operation during cold weather moisture can be expected to condense here until the area is warmed. However, if the walls have the required heat resistance the condition will clear up in a short time and remain in good condition.

To obtain the most efficient utilization of the air, the fan and intakes must be located in relation to each other so that the air coming in through the intakes will sweep the entire area of the stable as it moves toward the fan, leaving no dead air spaces. Usually it is not necessary to provide intakes in the wall in which the fan is located. The air entering such intakes will only move along the wall toward the fan.

In cases where two-fan systems are used both fans should be located side by side. If they are separated each fan will have its sphere of influence. At the neutral point between these two spheres dead air spaces or eddying currents may develop. This is shown in Figs. 2 and 3.

Each intake should have 60 sq in of area. The number needed is determined on the basis of one for each four head of 1000-lb cows. They should be evenly spaced along the walls, except the one in which the fan is mounted. There should be one in each corner of the barn. One or two adtional intakes may need to be installed later in some areas that continue to be damp. The intakes are designed to direct the incoming air straight upward, discharging it against a flat surface at the ceiling. When the air stream hits this surface, it loses its velocity and is broken up and dispersed in all directions. Part of the air mixes with the warm air at the ceiling, while part of it, being cold and heavy, moves down along the wall to the floor. Observations have led to the theory that this blanket of cold air next to the wall has some advantages. Apparently it prevents the warm moist air of the interior of the barn from coming in contact with the wall, windows, and doors, thus affording less chance of condensation and decreasing the heat loss through the walls. This theory is based on the fact that in several instances higher temperature was maintained and less condensation occurred than should have according to calculations for the wall construction and outside weather conditions.

The outlet of the intake should be from 12 to 15 in below the ceiling. Hinged covers may be installed on the intakes to control the air intake on stormy days. These covers should be cut one inch narrower than the intake so the air flow can not be completely stopped. Figs. 4 and 5 shows the details of two types of intakes, one for frame walls and one for masonry walls. It has been found that the flashing and insulation can be omitted.

Although in most cases it is much simpler to provide intakes to introduce the air from the outside through the barn walls, it is advantageous to take the air from the mow. The air in the mow may be a few degrees warmer than outside air, and, furthermore, the air flow through such intakes is not affected by outside air currents.

Although not generally recommended, there are some cases where windows may be used as intakes. They should be well distributed around the barn and the tops at least 12 in below the ceiling. A vertical board or metal strip should be fastened to the top of the window to direct the air straight upward toward the ceiling. Better air control can be obtained through the use of the special intakes.

No intake should be closer than 10 ft to the fan. All openings such as windows, doors, and hay chutes should be kept closed if the system is to operate satisfactorily. All cracks should be plugged and the barn made as tight as possible.

Ventilation Equipment. As is the case with practically all types of equipment, the quality of ventilation equipment varies from excellent to very inferior. The fan is the heart of any ventilating system. No system is better than the fan used. There is no application more severe for a fan than the ventilation system in a livestock barn. It must operate continuously over long periods and exhaust dust, moisture, and ammonia fumes, all of which play havoc with motors if allowed to come in contact with the windings and interior mechanism. The motor should be totally enclosed and be equipped with bearings that require lubrication only once during the ventilating season. Because of their unstable speed characteristics and low-starting torque, shaded pole motors are not suitable for this application. Split-phase or capacitator motors have proven to be satisfactory.

The fan frame and blade should be non-corrosive to resist the attack of the moisture and gases to which it is subjected. It should have non-overloading characteristics and be capable of operating against wind pressure without overloading the motor. It is very important to select a fan with

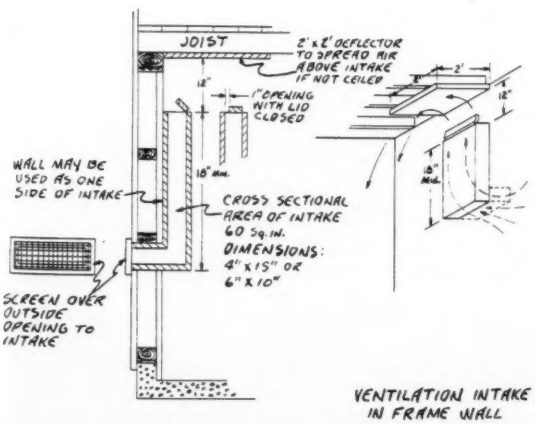

JOIST
2' x 2' DEFLECTOR TO SPREAD AIR ABOVE INTAKE IF NOT CEILED
1" OPENING WITH LID CLOSED
WALL MAY BE USED AS ONE SIDE OF INTAKE
CROSS SECTIONAL AREA OF INTAKE 60 Sq. in.
DIMENSIONS: 4" X 15" OR 6" X 10"
SCREEN OVER OUTSIDE OPENING TO INTAKE
VENTILATION INTAKE IN FRAME WALL

Fig. 4 Details of ventilation intake in a masonry wall

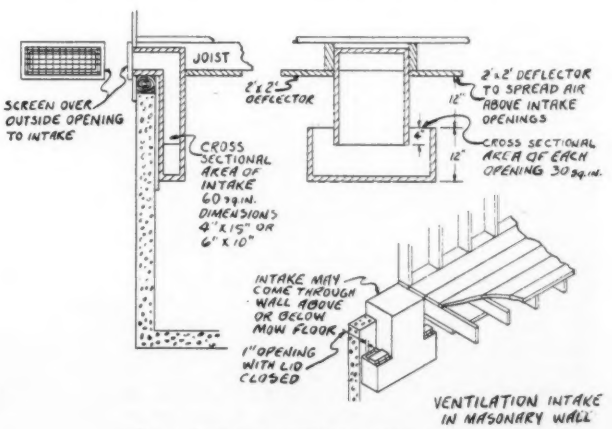

JOIST
SCREEN OVER OUTSIDE OPENING TO INTAKE
2' x 2' S DEFLECTOR
2' x 2' DEFLECTOR TO SPREAD AIR ABOVE INTAKE OPENINGS
CROSS SECTIONAL AREA OF INTAKE 60 sq. in. DIMENSIONS 4" X 15" OR 6" X 10"
CROSS SECTIONAL AREA OF EACH OPENING 30 sq. in.
INTAKE MAY COME THROUGH WALL ABOVE OR BELOW MOW FLOOR
1" OPENING WITH LID CLOSED
VENTILATION INTAKE IN MASONARY WALL

Fig. 5 Details of ventilation intake in a frame wall

the correct capacity for any ventilation job. The capacity of any fan depends on the type, number, and pitch of the blades as well as the diameter. Formerly all manufacturers rated propeller or disk fans on diameter rather than the amount of air they would deliver. In fact, some fans are still rated on that basis.

In 1939 a group of propeller fan manufacturers organized the Propeller Fan Manufacturers Association, and this association has adopted a standard test code for propeller and disk fans as sponsored by the American Society of Heating and Ventilating Engineers and the National Association of Fan Manufacturers. All fans bearing the certification insignia of this association have been tested by its code and the ratings are certified to be correct. This insignia assures the purchaser that any fan bearing it will perform according to the manufacturer's rating.

Controls. Whether the temperature or the humidity or both should be controlled is another question to which we have no definite answer. To date, temperature control is the only one that has worked with any degree of success, and is the one most widely used. This is largely because thermostats are more reliable than humidistats. Thermostats are more rugged, and if rust-resistant ones with enclosed contact points are used, they work quite satisfactorily. On the other hand, a humidistat is rather delicate, especially the element. When used in a dairy barn or poultry house, they work fairly well for a time. Before long the moist dust in the barn collects on the element causing it to become insensitive to moisture changes in the air. The elements are so delicate that it is practically impossible to clean them without damage.

POULTRY HOUSE VENTILATION

One of the greatest problems that the poultryman has is keeping the litter dry. If he can do this, he can eliminate the job of changing the litter, reduce the number of dirty eggs, and provide a more sanitary condition for the birds. He is also concerned about drafts, low temperatures, objectionable odors, and condensation of moisture on the walls and ceilings.

The ventilation of poultry houses is similar in many respects to that of dairy barns. However, in designing the system more consideration must be given to certain factors than in the case of dairy barns. It must be remembered that a hen is a much smaller heating plant than a cow and that there is much more air space per animal unit than in any type of livestock shelter. George W. Kable[5] in a paper, entitled "Electric Ventilation of Poultry Houses" published in the February, 1946, issue of AGRICULTURAL ENGINEERING, presented a very able discussion of various factors involved and gave brief summaries of the findings of several investigators.

To keep the litter dry in any poultry house two things must be accomplished, namely, (1) remove the moisture given off by the birds (about 1/3 lb per 4-lb bird per day) and (2) prevent the moisture in the air at the floor level from condensing in the litter. This accomplishment requires some type of positive ventilation and some means of keeping the floor litter slightly warmer than the air directly above it.

An electric ventilation system, if properly selected and installed in a poultry house with walls of sufficient heat resistance, will effectively remove obnoxious odors and excessive moisture. It may not, however, solve the problem of wet litter where one or more of the following conditions exist: (1) Not enough floor space per bird, (2) excessive spilling of water around drinking fountains, (3) opening of windows near the fan, (4) cold, uninsulated floors, or (5) poor drainage in case of concrete floors.

Most of these conditions result from poor management. The use of deep, dry litter will often solve the problem of cold floors. Concrete floors in contact with the ground on well-drained sites are usually warmer than floors with an air space under them. However, some type of vapor seal should be used or a layer of gravel or cinders used to prevent the capillary movement of moisture from the ground to the concrete floor.

The same type of system used for dairy barn ventilation has been used successfully in poultry houses. The amount of air which should be used has not been too well established.

Investigations conducted by the poultry husbandry and agricultural engineering departments[6] of Cornell University have indicated that for light breeds, such as Leghorns, 2 cfm per bird, and for heavy breeds, such as Plymouth Rocks, 2 2/3 cfm per bird is satisfactory in poultry houses with walls having a heat resistance of about 2. Another way to arrive at the fan capacity is to base the required air flow on the floor area. The general recommendations on floor space to be provided per bird are 3 sq ft for light breeds and 4 sq ft for heavy breeds. Assuming that these recommendations are followed, the fan capacity may be calculated on the basis of 2/3 cfm per sq ft of floor space used by the birds. This rate of air flow has proven to be quite satisfactory in numerous installations.

The same type of intake used in dairy barn ventilation is satisfactory for use in the poultry house. One intake with an area of 60 sq in should be provided for each 250 sq ft of floor space in larger houses. There should be one intake in each corner of the house. The remainder of the required intakes should be evenly spaced around the walls. No intake should be within 10 ft of the fan.

In the case of small poultry houses it may be advantageous to use smaller intakes in order to get better distribution of the incoming air. As in the case of dairy barns, the intakes and fan should be located in relation to each other so that the fresh air will sweep through all parts of the house in traveling from the intakes to the exhaust duct without leaving any dead air pockets.

In poultry houses with the perches located along one side, the fan and exhaust duct should be located about the center of that side and the intakes distributed along the ends and opposite side. Such an arrangement will prevent the cold air from the intakes spilling on the birds at night when they are on the perches.

The method of ventilating poultry houses just discussed has proven to be very satisfactory to a majority of poultrymen using it. Several poultrymen, however, prefer higher temperatures than they have been able to maintain. Some have been trying some supplemental heat and report very favorably on its use. It has been stated by several investigators that 20 to 22 F is the critical temperature for active hens and 32 to 40 F for inactive hens. Some poultrymen report that so long as the temperature in the laying house does not go lower than 20 F no reduction in egg production has been noted. On the other hand, others maintain that for best production a minimum of 40 F should be maintained. More definite information is needed on this question and others listed by Kable[5].

It should be borne in mind that, although experience has shown that electric ventilation is well justified in a poultry house, it is only one factor in poultry house management. It will not counteract poor management practices.

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2 F. L. Fairbanks and A. M. Goodman. Dairy Stable Ventilation, Cornell Extension Bulletin No. 151, December, 1926, revised June, 1943.

3 H. P. Armsby and Max Kriss. Some Fundamentals of Stable Ventilation, Journal of Agricultural Research, vol. XXI, no. 5, reprint June, 1, 1921.

4 M. A. R. Kelley. Principles of Dairy Barn Ventilation, Farmer's Bulletin No. 1393, U. S. Department of Agriculture.

5 Geo. W. Kable. Electric Ventilation of Poultry Houses, AGRICULTURAL ENGINEERING, vol. 27, no. 2, February, 1946.

6 C. N. Turner. Ventilate Poultry House with Electric Fans, Farm Research, vol. XIII, no. 3, July, 1947.

RESEARCH NOTES

A.S.A.E. members and friends are invited to supply, for publication under this heading, brief news notes and reports on research activities of special agricultural engineering interest, whether of federal or state agencies or of manufacturing and service organizations. This may include announcements of new projects, concise progress reports giving new and timely data, etc. Address: Editor, AGRICULTURAL ENGINEERING, St. Joseph, Mich.

USDA Notes on Ultrasonics, Feed Grinding and Mixing, and Placement of Radioactive Fertilizer

Ultrasonic Investigations. The Division of Farm Electrification, USDA, has a high-intensity ultrasonic generator which has been used for preliminary studies with other divisions of the BPISAE and in cooperation with other ARA bureaus. The studies have indicated some of the practical agricultural applications of ultrasonics and some of the problems in applying high-frequency sound radiations produced electrically.

Agricultural engineers Lowell E. Campbell and Leonard G. Schoenleber list the following agricultural uses of ultrasonics as seeming to warrant immediate investigation: biological effects on plant and animal materials, bacterial control, sterilization or pasteurization of milk and other food products, homogenization of milk, emulsification and near dispersion in liquids, coagulation of particles suspended in fluids, and control of insects and diseases.

In cooperation with the Bureau of Entomology and Plant Quarantine the engineers tested ultrasonic effects on insects and killed mosquito larvae in 5 sec. The limited tests showed the percentage of mortality of the larvae to be directly correlated with the amplitude of the waves and, within limits of the experiment, the percentages did not differ significantly with length of exposure. On examination mosquito larvae killed by high-intensity sound waves appeared to be literally torn apart. Under similar conditions larvae of the codling moth required exposures of up to a full minute for killing. When they were imbedded in fruit, these larvae apparently were undisturbed.

The Bureau of Entomology and Plant Quarantine was also interested in whether ultrasonic sterilization of citrus fruits offered a feasible means of fruit fly control. The cooperative tests on orange juice were discouraging because they indicated that the amount of vitamin C remaining after exposure was inversely related to the time of exposure.

Other Farm Electrification Division tests indicate that the germination period of certain seeds and tubers may be reduced by treatment with ultrasonics and that particles of DDT can be reduced by ultrasonic vibration to smaller size than has heretofore been possible by the usual processes.

Feed Grinding and Mixing. W. M. Hurst of the Division of Mechanical Processing of Farm Products has completed a report on his study made in cooperation with the Farm Credit Administration's Cooperative Research and Service Division of plant design and operations in 26 farmers' cooperative feed grinding and mixing plants in 11 states. This is Miscellaneous Report 125, "Farmers' Cooperative Feed Mills — Plans and Operations," issued by FCA October, 1948.

While a few large feed manufacturing plants were included in Mr. Hurst's survey, the study was confined largely to those serving farmers in a community or area with similar feeding practices. The number of different feeds manufactured range from 7 to 26 at the various batch and line mix-type mills. The small batch mix plants ranged in capacity from 1 to 2 tons per hour, batch manufacturing plants from 10 to 18 tons per hour, and line mix plants from about 20 to 30 tons per hour.

Several of the mills visited had bins, an elevator, a mixer, or some other piece of equipment which constituted a bottleneck in operations. Findings indicate that it is usually advisable to plan a complete mill from the ground up rather than to place feed-making equipment in an existing warehouse or other building. In a converted plant it is difficult to arrange an efficient flow of materials through the various steps, with the result that operating costs are high.

The report of this study includes sketches of the several types of mills, some of them showing suggested changes in equipment and layout for possible improvements in performance. Other topics considered are labor requirements, warehouse handling, one-floor operations, simplified construction, bins, and machinery.

Mr. Hurst is the author of two previous FCA reports in this series: "Layout and Operations of Cooperative Poultry Dressing Plants," which is No. 101, and No. 107, "Farmers' Produce Markets in the United States, Part II: Plans and Facilities." These were issued in December, 1946, and May, 1947, respectively. They have been rather widely used by cooperatives building and remodeling their plants and modernizing their equipment.

Placement Machinery for Radioactive Fertilizer Experiments. Expansion of field tests with radioactive materials, particularly phosphorus, to include several states in addition to the five where work was done this year was discussed at a meeting of soil scientists of BPISAE and 17 state agricultural experiment stations and representatives of the Atomic Energy Commission at Beltsville, November 29 - Dec. 2, 1948. The conference reviewed cooperative work this past year in New York, North Carolina, Georgia, Iowa, and Colorado. States also represented at the meeting were: Pennsylvania, Maryland, Virginia, North Carolina, Florida, Mississippi, Texas, Ohio, Indiana, Missouri, Wisconsin, and California.

Glenn A. Cumings, in charge of the fertilizer placement project in the USDA Farm Machinery Division, addressed the conference on "Fertilizer Placement Machinery Adapted for Experiments with Radioactive Fertilizers." The adaptation of fertilizer placement machinery for use with radioactive phosphates, he explained, is mainly concerned with the fertilizer-dispensing system. Protection of workers against harmful radiation and contact with air-borne dust particles of the radioactive material are the principal considerations.

Safety provisions include (1) a type of hopper in which a minimum amount of material can be deposited for a single continuous operation; (2) dispensing of all material from the hopper during each run; (3) shielding of the material in the hopper by 1/6 to 1/4 in of aluminum or its equivalent weight of any other material (a thickness of 1/6 in of inum is considered an effective shield, but a thickness of 1/4 in provides unquestionable protection); (4) elimination of pockets, ledges, and obstructions where the material may accumulate, also avoiding the use of improperly designed furrow openers which may readily clog, and (5) transparent shielding in such areas as may be required to detect easily accumulations of the material and to permit visibility when loading the hopper from suitable containers.

Minimizing the escape of dust is obviously one essential safety provision, and should include as complete enclosure of the hopper and delivery tubes as possible or feasible. Broadcasting of fertilizer by placement in closely spaced furrows prevents the excessive dispersion of dust in the air which accompanies surface broadcasting. Endless-belt-type hopper machines adapted for this work at the Agricultural Engineering Laboratory, Beltsville, were described in Research Notes in AGRICULTURAL ENGINEERING for July, 1948.

This picture shows part of the crowd of more than 1300 representatives of government, industry, state colleges and experiment stations, and farmers from eighteen states and two foreign countries watching the demonstration of cotton strippers and other cotton mechanization equipment held in connection with the Belt-Wide Cotton Mechanization Conference at Lubbock, Tex., October 14 to 16, 1948

NEWS SECTION

Nominations for 1949-50 ASAE Officers

THE NOMINATING Committee of the American Society of Agricultural Engineers has placed in nomination the following members of the Society for the various elective offices to be filled at the next annual election of officers to be conducted by letter ballot:

For President:

Frank J. Zink, consulting agricultural engineer, Frank J. Zink Associates, Chicago, Ill.

For Councilor:

John R. Carreker, agricultural engineer, Soil Conservation Service, U S Department of Agriculture, Watkinsville, Ga.

Fred A. Kummer, head, agricultural engineering department, Alabama Polytechnic Institute, Auburn.

For Councilor:

K. W. Anderson, research engineer, Deere & Company, Moline, Ill.

E. W. Tanquary, engineering specialist, farm implement division, International Harvester Co., Chicago, Ill.

For Nominating Committee:

O. C. French, head, agricultural engineering department, Cornell University, Ithaca, N. Y.

W. E. Meek, senior agricultural engineer (BPISAE), U S Department of Agriculture, Stoneville, Miss.

R. M. Merrill, agricultural engineer, Deere & Company, Moline, Ill.

Aldert Molenaar, professor of agricultural engineering, State College of Washington, Pullman.

J. A. Schaller, advertising manager, Rilco Laminated Products, Inc., St. Paul, Minn.

D. G. Womeldorff, manager of rural sales, Public Service Co. of Northern Illinois, Chicago, Ill.

The By-Laws of the Society provide that by March 1st of each year, the Secretary of the Society shall mail each member, entitled to a vote, a ballot stating the names of the candidates for elective office to be filled at the next election.

New Record Interest in ASAE Winter Meeting

ATTENDANCE at the Winter Meeting of the American Society of Agricultural Engineers in Chicago, December 13-15, reached a new high with a registration of 784. This may be interpreted as the result of a combination of influences, including the growth of the Society, a strong program, and increased support for agricultural engineering work by both industry and public service agencies.

The program, which cannot be reviewed here in detail, closely followed the outline published in advance of the meeting.

Even with the larger attendance and increased numbers of new members and visitors present for the first time, the meeting retained its characteristic businesslike atmosphere, with close attention to the scheduled sessions, and with many making the most of time between sessions to talk shop with old and new acquaintances.

A committee from the Chicago Section of the Society provided a new and valuable service in helping to handle registration and public relations matters, and otherwise expediting the smooth development of the meeting.

A strong representation of engineers with the farm equipment industry supported the heavy, six-session schedule of the Power and Machinery Division. Three half-day sessions on complete units — forage handling equipment, spray equipment, and tractors, — were balanced by three half-day sessions on the design problems of stress analysis, bearings, and hydraulic controls.

Continued engineering progress in its field was reflected in sessions of the Soil and Water Division. Commercial representation and participation in the program on drainage, irrigation, and pond building helped to emphasize the economic considerations involved, and the economics of conservation received professional attention in the session on that subject.

Basic data, problems, and commercial developments in grain drying were brought together to clarify the over-all picture of this subject in the one joint session of the Farm Structures and Rural Electric Divisions.

Separately the farm structures group program reflected active current interests in light weight concrete, glued framing, heat exchanger applications in barn ventilation, farm building management, fire tests, and research.

Engineering aspects of rural electrification were emphasized in other sessions of the Rural Electric Division, and commanded intensive interest. Heating, lighting, and supersonic applications, wiring problems and developments, research techniques, product improvement, and a survey of current rural electric activities were the general subjects covered as fully as time permitted.

A capacity attendance turned out for the Monday evening session of the College Division, and were briefed on recent developments in the field of professional agricultural engineering training. A lively discussion followed the panel presentation of the accrediting situation, with particular reference to the suggestion that agricultural engineering training be limited to clearly distinguishable professional curriculums and service courses, with elimination of agricultural engineering as an

A.S.A.E. Meetings Calendar

January 20 — MINNESOTA SECTION, Dyckman Hotel, Minneapolis.

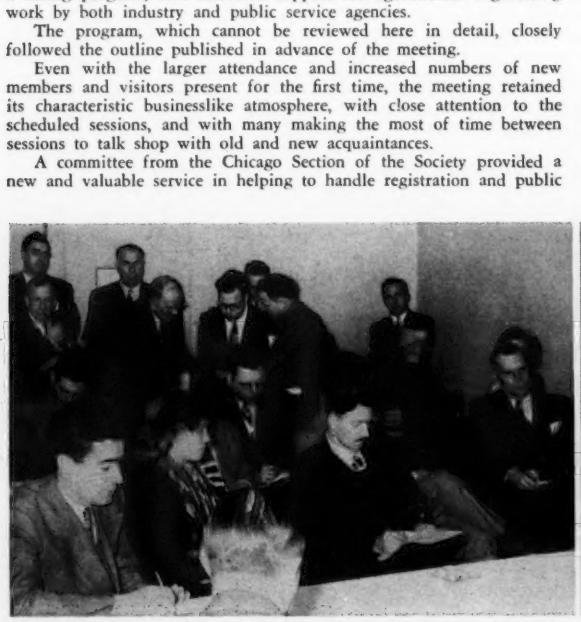
January 31 to February 2 — SOUTHEAST SECTION, Louisiana State University, Baton Rouge, La.

February 3 — PACIFIC COAST SECTION, University of California, Davis.

February 12 — MICHIGAN AREA SECTION, Michigan State College, East Lansing.

March 17 to 19 — MID-CENTRAL SECTION, Kansas State College, Manhattan.

June 20 to 23 — ANNUAL MEETING, Michigan State College, East Lansing, Mich.



Least conspicuous, but one of the most active spots at the ASAE winter meeting in Chicago was the "press room" where a special committee of the Chicago Section made press relations history for ASAE. At the left are shown representatives of press and radio interviewing the experts shown at the right — Roy Bainer, A. W. Turner, A. W. Farrall, T. E. Hienton, and J. B. Kimberley

authorized major subject for a degree in agriculture.

An evening round table sponsored by the Committee on Hay Harvesting and Drying applied some heat to that subject. The Committee on Extension met in connection with its general program and then regrouped to give specific attention to extension problems in farm safety and in farm housing.

The Standard Oil Company of Indiana proved a gracious host to those who were able to accept its invitation to visit its laboratory and refinery at Whiting, Ind., on Thursday, following the meeting. Features of the trip included an introductory talk and non-technical moving picture on petroleum refining; a guided tour of the refinery and catalytic cracking plant area, the candle factory and the research laboratory; lunch in the laboratory cafeteria; and a souvenir package of Christmas candles for each guest.

Southeast Section to Meet at Baton Rouge

THE SOUTHEAST Section of the American Society of Agricultural Engineers will meet January 31 through February 2, in conjunction with the annual convention of the Association of Southern Agricultural Workers, on the campus of Louisiana State University at Baton Rouge. One feature of the meeting will be a full-day program (February 3) on cotton mechanization, sponsored jointly by the Southeast and Southwest Sections and the Power and Machinery Division of ASAE.

G. I. Johnson, chairman of the Southeast Section, will preside at the opening session of the meeting on Monday, January 31. Machinery and chemicals for weed control and for insect control, peanut harvesting machinery, and a new sweet potato harvester are to be covered in this session.

A symposium on agricultural engineering curriculums, followed by another on extension methods, will occupy the afternoon session, at which R. H. Driftmier is to preside.

Crop drying will be the main subject for the Tuesday forenoon session, with Southeast Section Secretary Harry Dearing presiding as chairman. Small grain and peanut drying are scheduled for specific attention, along with the North Carolina farm crop drier and drying crops with chemically dried air.

Farm structures are to be the main subject of the Tuesday afternoon program. John W. Weaver, vice-chairman of the Southeast Section, will preside. Extension methods, dairy structures, lightning protection, and termite control are the specific phases of farm building progress to be discussed. This session is to close with a motion picture on modern land clearing.

The annual business session of the Section is scheduled for 4:00 p.m., and the annual Section banquet at 7:00 p.m.

Concurrent programs on cotton mechanization and on irrigation will fill the final day.

The joint program on cotton mechanization will open with contributions on stalk disposal and land preparation. Elimination of hand thinning by flame, mechanical chopping and cross plowing, and planting to stand; and cultivation and weed control will occupy the remainder of the program.

In the afternoon mechanical harvesting will be considered, with contributions on strippers, spindle pickers, and cost and efficiency. Contributions on ginning mechanically harvested cotton will round out this crop-cycle treatment of cotton mechanization.

Irrigation sessions will feature a symposium on pumps, a committee report on supplemental irrigation in the Southeast, and reports from a number of observers on irrigation field results.

Copies of the program and other information about this meeting may be obtained from Harry Dearing, secretary, Southeast Section, 1010 Brown Marks Bldg., Birmingham, Ala.

Pacific Coast Section Program

THE PACIFIC COAST Section of the American Society of Agricultural Engineers will hold its 27th annual meeting in the Agricultural Engineering Building on the University of California campus at Davis, on February 3. The meeting will be preceded by a two-day rural electrification conference at Davis, which offers a program of particular interest to agricultural engineers.

There is also scheduled on the two days following the Pacific Coast Section meeting — February 4 and 5 — the annual farm machinery conference that has been sponsored for a number of years by the agricultural engineering division of the University of California. This conference also offers a program of special interest to agricultural engineers.

The forenoon program of the Pacific Coast Section meeting on February 3 will open with an address by Dean of Agriculture K. A. Ryerson on an enlarged college of agriculture. This will be followed by Ray Bainer, head of the agricultural engineering division of the University of California, who will discuss the research programs under way by his division. He will be followed by a talk on weather and frost protection research by Dr. F. A. Brooks of the same division.

Two other papers, one on water irrigation needs of the Pacific Coast, by Irvin H. Althouse, engineer of the Terra Bella Irrigation District, and the other on water and power needs of the Pacific Coast by G. C. Tenny, editor and publisher of Electrical West, will conclude the forenoon program.

A luncheon session will be held at the University Airport and will include, in addition to the Section's business session, a talk by C. H. Hopkins, a California farmer, on the contributions of flying to farming.

The afternoon program will open with a paper on instruments for heat measurement by C. F. Kelly and T. E. Bond, USDA agricultural engineers. W. J. Welker, service manager, John Bean, (Western) Division, Food Machinery Corp., will discuss the subject of marketing research ideas. Professional registration of agricultural engineers will be the subject of a talk by P. H. Calahan, executive secretary of the (California) State Board of Registration for Civil and Professional Engineers. The closing number on the program will be a talk on standardization by C. T. Rasmussen, chief engineer, John Deere Killifer Co.

For copies of the program and other information concerning the meeting, persons interested should write Section Secretary W. W. Weir, 320 Hilgard Hall, University of California, Berkeley 4.

Sprague New Pennsylvania Section Chairman

THE PENNSYLVANIA Section of the American Society of Agricultural Engineers at its last meeting elected David C. Sprague, professor of agricultural engineering, Pennsylvania State College, as its new chairman for the ensuing year. The new vice-chairman of the Section, elected at the same meeting, is Walter W. Carson, manager, rural service department, West Penn Power Co., Pittsburgh. Elwood F. Oliver, instructor in agricultural engineering at Penn State, was elected secretary-treasurer of the Section.

The meeting at which these elections took place was a two-day affair, the first day's sessions being held at Hotel Green Gables in Lewiston. The program, held in the afternoon, was a symposium on dairy barn ventilation. The Section dinner was held the same evening

***(Left)*: John Wessman, second from right, vice-chairman, Chicago Section, was in charge of publicity for the ASAE winter meeting, ably assisted by George Singer, extreme left, and Wendell Dean, on Wessman's right. J. P. Daneluk, extreme right, engineered the press conferences and produced the press releases. Mrs. Swanson, behind the typewriter, did "yeowoman" service for the press room crew. Standing, left to right, Earl Anderson, member, ASAE Council, and Dawson Womeldorff, chairman, Chicago Section • *(Right)*: B. D. Moses and A. W. Farrall, chairmen, respectively, Rural Electric and College Divisions, confer with ASAE President A. J. Schwantes, at extreme right, during ASAE winter meeting.**

with Ausmus S. Marburger, general manager of Hertzler and Zook Division of the Sperry Corp., presiding toastmaster. A. W. Clyde, professor of agricultural engineering at Penn State, was the dinner speaker, his subject being on the place of the engineer in industry. The dinner was followed by a round-table on forage crop handling equipment.

The session on the second day of the meeting, November 3, was held in the agricultural engineering building on the Penn State campus, with E. K. Bonner, Jr., retiring chairman of the Pennsylvania Section presiding. The program featured chemical weed control, vacuum crop blowers, small riding tractors, and mow curing of hay.

Alabama Section Presents Good Program

SIXTY AGRICULTURAL engineers (mostly members of the Alabama Section of the American Society of Agricultural Engineers), student agricultural engineers, and other persons interested in the field of agricultural engineering, assembled at Birmingham, Ala., at 1:00 p.m., Friday, December 10. From there the group proceeded to the Fairfield steel mill of the Tennessee Coal, Iron, and Railroad Co. where Harry Dearing conducted the group on a tour to observe the blast furnaces, open-hearth furnaces, booming mills, and rolling mills. From the Fairfield plant, the group was taken to the Ensley plant for a trip through the basic slag fertilizer mill.

At 7:00 p.m., a meeting was held at the Molton Hotel with Section Chairman E. C. Easter presiding. Following the dinner, two discussions were held. The first conducted by Harold M. Schudt, general manager of the Allis-Chalmers Mfg. Co.'s plant at Gadsden, Ala., on the purposes and progress of this plant. Charles Christopher, president, Gadsden Steel Buildings, Inc., Gadsden, Ala., introduced David Poor of the Great Lakes Steel Corp., who talked on the use of the Quonset building for farm structures.

At 9:00 a.m., Saturday, December 11, the Section met in the auditorium of the Alabama Power Co.'s building for a meeting presided over by Section Vice-Chairman W. A. Womack. Fred G. Mylius, Thomas Steel Products Co., Birmingham, talked on the use of aluminum buildings for farm structures. A panel discussion on rural electrification led by Harry B. Pfost followed. E. C. Easter, of the Alabama Power Co., discussed the growth and history of rural electrification. E. H. Chambers of the Alabama Agricultural Extension Service talked on the relationship of the extension service to the farmer. Joe Hixon, rural service engineer, Alabama Power Co., led a discussion on the relationship of the utility engineer to the farmer. A panel discussion of soil conservation was led by F. E. Kummer, head of the department of agricultural engineering, Alabama Polytechnic Institute. Lawrence Ennis, agricultural engineer with the Alabama Extension Service, led a discussion on Alabama's drainage district law. Tom Peacock, Florida Land Clearing Equipment Co., Jacksonville, Fla., gave a discussion on the use of their equipment in land clearing, which included a movie showing the equipment being used for clearing land of trees, brush, and rocks.

Conservation Research

TO THE EDITOR:

I WAS VERY MUCH interested in the fine editorial, entitled "Conservation Research" in AGRICULTURAL ENGINEERING for November, 1948.

Too often, the basic importance to a sound soil and water conservation program is overlooked. In the final analysis, of course, what counts is the application of research findings to the solution of problems on farms and ranches of the country. But research must come first and, as your editorial so aptly points out, there is no limit to the amount of knowledge which it might produce.

It was very encouraging to find such a clear analysis of the importance of soil conservation research, not only for increasing farm productivity and income, but as an activity of "continuing interest to the whole human race."

THOMAS S. BUIE
Regional Conservator (Region 2)
Soil Conservation Service, USDA

Minnesota Section Meets January 20

THE MINNESOTA Section of the American Society of Agricultural Engineers will hold its annual dinner meeting at 6:15 p.m., Thursday, January 20, in the Tropical Room of the Dyckman Hotel in Minneapolis. All members of ASAE, whether members of the Minnesota Section or not, and other persons interested, are cordially invited to attend this meeting.

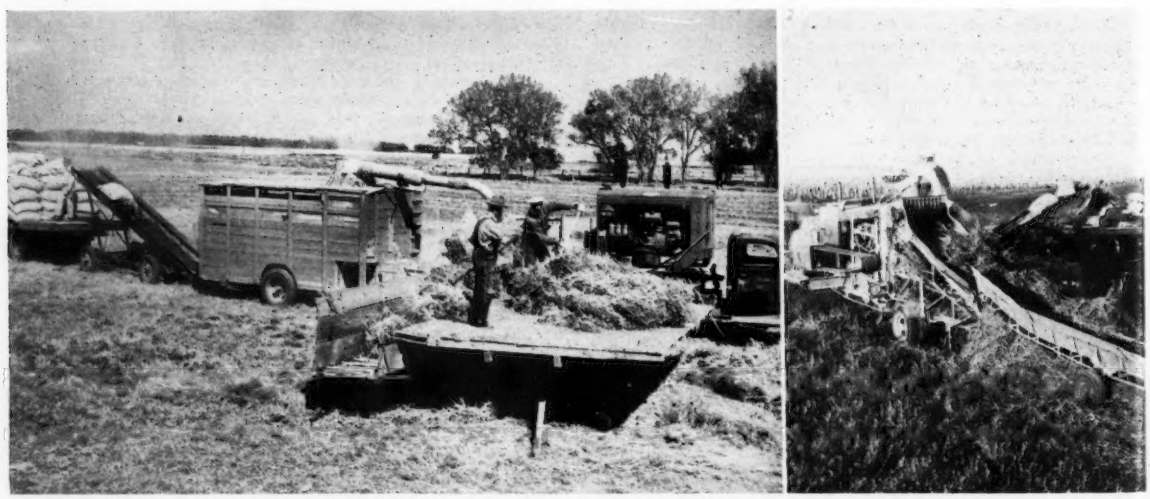
The feature of the program will be a combined talk and exhibit on the subject "Research and Chemurgy" by V. S. Peterson of the extension division of E. I. DuPont de Nemours and Co.

A short business session will be held at this meeting for the installation of new officers of the Minnesota Section for the ensuing year.

Michigan Moisture Testing Papers Available

FOUR PAPERS on moisture testing methods, by S. T. Dexter, section of farm crops, Michigan Agricultural Experiment Station, East Lansing, have been reprinted from the Station's Quarterly Bulletin.

In their order of original publication they are "A Method for Rapidly Determining the Moisture Content of Hay or Grain" (November, 1947), "A Method of Estimating Whether Hay or Grain Will Keep in Storage" (November, 1947), "A Colorimetric Test for Estimating the Percentage of Moisture or the Storage Quality of Farm Products or Other Dry Materials" (May, 1948), and "An Oil-Distillation Method for Determining the Moisture Content of Farm Crops" (November, 1948).



PORTABLE ALFALFA MILLS CUT MILEAGE AND SPEED CROP TO MARKET

At Cozad, Nebraska, called "the world's greatest alfalfa producing and shipping center", the Brown Brothers Company operate two large portable alfalfa mills. The outfit shown at the left includes a 36-in hammermill. Seven tons of alfalfa per hour are milled through the ¼-in screen of this mill and then bagged and loaded on to a truck for immediate shipment to market. The hay is brought from the stacks in the field to the loading platform of this outfit with a tractor-mounted mechanically operated fork. Two men pitch the hay into the feed conveyor. Three men are required at the sacking unit, two bagging and one stitching the sacks. Another member of the crew stacks the bags on the truck. The newest and largest of these portable alfalfa mills is shown at the right. This mill has a top performance record of 553½ tons of alfalfa meal bagged in 8 hrs. Both mills are powered by an International UD-24, 180-hp diesel engine. The mills and engines of these two outfits are mounted on truck trailers. Other sections are equipped with wheels so that they may be hauled to any location in the field

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Personals of A.S.A.E. Members

Fred L. Aldred, Jr., a recent graduate in agricultural engineering of the University of Georgia, has received appointment as junior agricultural engineer, agricultural engineering divisions (BPISAE), U. S. Department of Agriculture. He will be engaged in research work in rough rice drying, conditioning, and storage, and will be located at Beaumont, Texas.

Clarence F. Anderson, technical representative, export department, J. I. Case Co., was recently transferred from Buenos Aires, Argentina, to Santiago, Chile, where he will supervise the distribution and application of Case agricultural machines and implements in that country.

Kailash Chandra, formerly employed as surveyor in the engineering department of the Allahabad Agricultural Institute, Allahabad, India, is now employed as agricultural engineer (chargeman) by the Central Tractor Organization of the Ministry of Agriculture of India.

Warren H. Corbet has recently accepted appointment as an hydrologic engineer in the Bureau of Reclamation, U. S. Department of the Interior. He is located at Grand Island, Neb., office of the Bureau, and is engaged in work connected with the Lower Platte River Basin.

Arjen J. Geerts has resigned as manager, farm equipment division, export department, Montgomery Ward & Co., to join in forming the Associated Manufacturers International Corp., an association representing a group of independent agricultural equipment manufacturers interested in foreign markets.

Arthur H. Hemker has been appointed manager of the farm industry division, apparatus department, General Electric Company. He succeeds G. A. Rietz in this position, and was formerly in charge of product development for the division.

John C. Keplinger, vice-president in charge of sales, Hercules Motor Corp., Canton, Ohio, was promoted to the position of executive vice-president of the Company at a meeting of the board of directors in December. Mr. Keplinger has been associated with Hercules since 1926 and has served progressively as a member of the sales staff, sales manager, and vice-president in charge of sales. He will continue to direct the sales activities of the company.

Frederick A. Lyman, formerly an account executive with Fuller & Smith & Ross, Inc., Cleveland advertising agency, is now product education manager of Harry Ferguson, Inc., at Detroit.

Horace L. Mitten, Jr., a recent graduate in agricultural engineering of Michigan State College, has received appointment as assistant professor in the department of dairy technology, Ohio State University, He will be engaged in teaching dairy plant engineering.

G. A. Rietz, formerly manager, farm industry division, apparatus department, General Electric Co., was recently made manager of the educational service section in the customer relations division of the executive department of General Electric Company. Mr. Rietz is a past-president of the American Society of Agricultural Engineers, a past-chairman of the Society's Rural Electric Division, and presently a member of the Council of the Society.

Roy T. Tribble has resigned as instructor in agricultural engineering at Michigan State College, to accept appointment for full-time research in irrigation practices with the agricultural engineering department of the Hawaii Agricultural Experiment Station at Honolulu.

John E. Wetzel has resigned as rural electrification specialist, Tennessee Valley Authority, to become district manager of the Southern States Cooperative at Benson, Md.

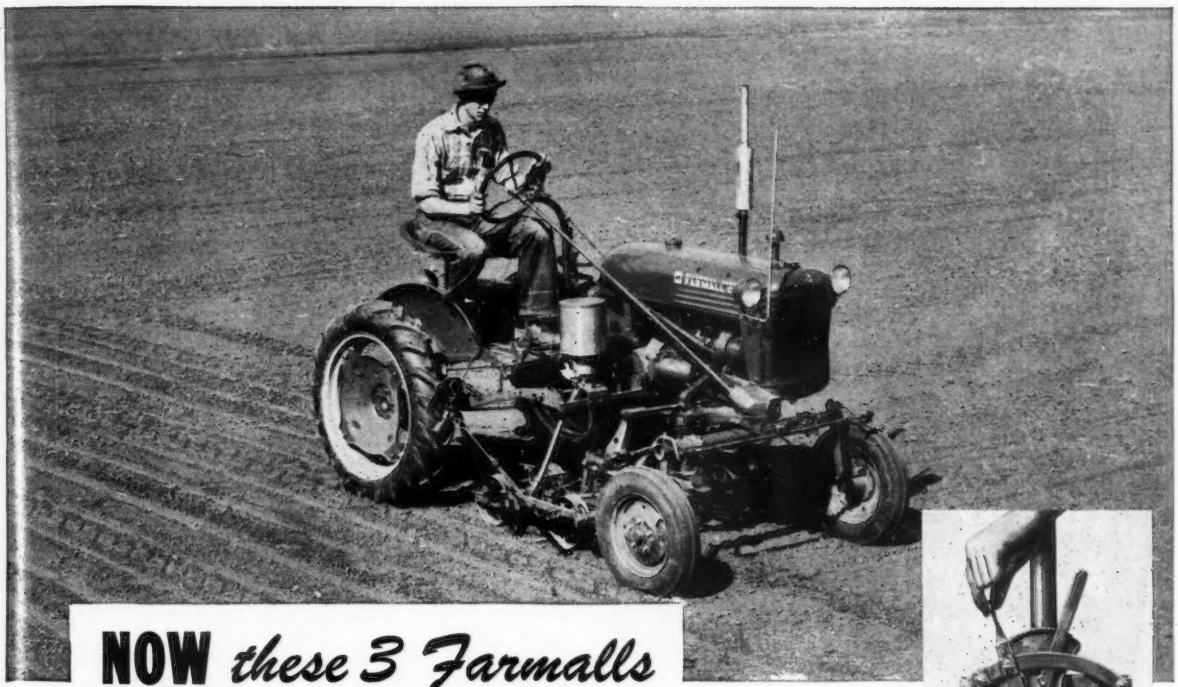
J. H. Wetzel is being transferred from his position as head of the safety and health section, Soil Conservation Service, U. S. Department of Agriculture, Washington, to become chief of the water conservation division of SCS Region No. 1 at Upper Darby, Pa.

Necrology

EDMUND CHESTER SAUVE, professor of agricultural engineering at Michigan State College, passed away at his home in Lansing, December 2, at the age of 61, following a brief illness.

Mr. Sauve graduated from Michigan Agricultural College in 1911, with a bachelor's degree in mechanical engineering. He continued his training with a two-year apprenticeship in gas engines at the Seiger Engine Works in Lansing. After this he returned to his alma mater to teach farm mechanics. In 1915 he went to the University of Wisconsin to teach agricultural engineering. In 1919 he returned to Michigan State College, and had been active in its farm mechanics and agricultural engineering teaching since that time. At the time of his passing he was in charge of the teaching in farm power and machinery.

He became a member of the ASAE in 1918. He was a member of the Church of the Resurrection, the Holy Name Society, Richard Council No. 788, Knights of Columbus, and the Orpheus Club of Lansing. He is survived by his widow, Catherine; a son Vincent M. Sauve of Chicago; a brother, Emile B. Sauve of Alpena, and three grandchildren.



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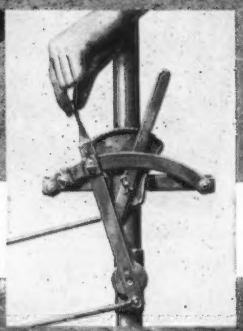

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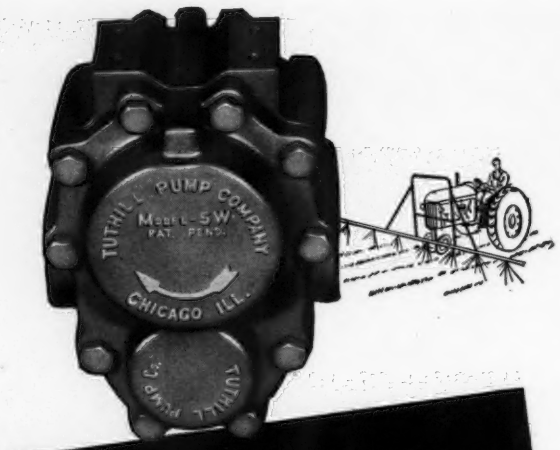

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- Built of highly corrosion-resistant materials to handle a wide variety of spray liquids.
- Self-priming . . . self-lubricating.

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Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Allan, Rodney H.—Instructor in agricultural engineering, University of Maine, Orono, Maine (Mail) So. Apts 16-A.

Anderson, Norman L.—Trainee, Caterpillar Tractor Co., Peoria, Ill. (Mail) 118 N. Institute.

Bartlett, Albert B.—Draftsman, Harry Ferguson, Inc., Detroit, Mich. (Mail) 9236 Yosemite St.

Beckett, Frederick E.—P. O. Box 1239, State College, Miss.

Belzile, G. Jacques—Assistant design engineer, E. J. Wright Utilities, Ltd., Strathroy, Ont., Canada

Berge, Joseph O.—305 Eighth St., Brookings, S. D.

Booker, Samuel H.—Rural engineer, Alabama Power Co., Tuscaloosa, Ala.

Brown, W. D.—Design engineer, The Oliver Corp. (Mail) 204 Ferguson, Charles City, Iowa

Brueck, D. A.—General farming and soil conservation contracting, Battle Creek, Iowa

Bueltel, Clarence J.—Agricultural engineer, Soil Conservation Service, USDA (Mail) Arcadia, Iowa

Burright, Leon C.—Farmer, Mendota, Ill.

Buss, Harold H.—Salesman, Snyder Implement Co., Wooster, Ohio (Mail) 305 N. Grant

Byers, Gordon L.—Assistant in agricultural engineering services, Nova Scotia Department of Agriculture and Marketing, Truro, N.S., Canada.

Carlisle, H. M.—Graduate student in agricultural engineering, University of Florida, Gainesville, Fla. (Mail) R. R. 1, Box 21-C

Case, Paul W.—R. R. 2, c/o P. G. Booth, West Mansfield, Ohio

Chandler, James R.—Territory supervisor, J. I. Case Co., Des Moines, Iowa

Cole, George—Field instructor, Dearborn Motors Corp., 15050 Woodward Ave., Detroit 3, Mich.

Commer, Bennett C.—Assistant county agent. (Mail) 421 Vanden Vender, New Madrid, Mo.

Conniff, Jack E.—Graduate assistant in agricultural engineering, Alabama Polytechnic Institute, Auburn, Ala.

Corke, Charles P.—Hydrologic engineer, Bureau of Reclamation, USDI. (Mail) P. O. Box 997, Grand Island, Nebr.

Day, Howard Q.—President, The Day Co., 306 West 69th St., Chicago, Ill.

Dendy, Farris E.—Veterans instructor on farm training program, Center High School. (Mail) Woodland, Miss.

Derrick, Rue V., Jr.—Instructor in agricultural engineering, A. & M. College of Texas, College Station, Tex.

Devine, John J.—Flax miller and tillage contractor, Churchminster, Ballindrait, County Donegal, Ireland

Dillon, Robert M.—Field engineer, Massey-Harris Co., Ltd. (Mail) R. R. 1, Cokksville, Ont., Canada.

Doherty, Philip B.—Assistant agricultural engineer, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA. (Mail) 3104 Oakland, Ames, Iowa

Durrell, K. A.—Salesman, The Pedlar People, Ltd., Oshawa, Ont., Canada. (Mail) 281 Simcoe St., S.

Falkner, Max H.—Assistant rural engineer and architect, Agricultural Extension Service, University of Tennessee, Knoxville, Tenn. (Mail) P. O. Box 1071.

Fowler, Patrick M.—Farmer, R. R. 1, Thomasville, N. C.

Freeman, George R.—Assistant regional engineer, International Harvester Co. (Mail) 1512 Donald St., Jacksonville, Fla.

Friedmann, Walter J., Jr.—Graduate student and laboratory assistant, Florida Agricultural Experiment Station, Gainesville, Fla. (Mail) 52 Flavet Village.

Funk, J. W.—Instructor in agricultural engineering, Kansas State College, Manhattan, Kans.

Gillentine, J. F.—c/o D. H. Bradford, 1498 Marjorie St., Memphis, Tenn.

Gollop, R. E.—Instructor in agricultural mechanics, Provincial Institute of Technology and Art, Calgary, Alta., Canada. (Mail) 329 A—17th Ave., W.

Greathouse, Brady B., Jr.—Itinerant vo-ag instructor, Humansville Public Schools, Humansville, Mo. (Mail) Box 245

Grosvenor, Dale D.—Junior standards engineer, John Deere Des Moines Wks. (Mail) 1212 So. 3rd St., Ames, Iowa

(Continued on page 42)

dust

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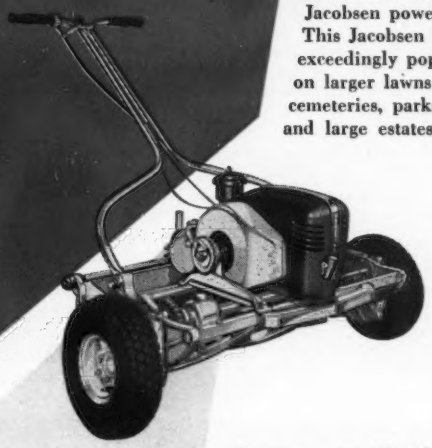

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The United Oil Bath Air Cleaner illustrated here is one of the 260 different United models. There is a size and type for every kind of internal combustion engine, large or small — for trucks, cars, tractors, buses, stationary and portable power units.

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Applicants for Membership

(Continued from page 40)

Guest, C. R.—Trainee, J. I. Case Co., 10th Ave. & 4th St., W., Calgary, Alta., Canada

Haag, M. L.—Junior partner, farming, c/o William P. Hinckley, Hoven, S. D.

Hammett, Lyman R.—Student in agricultural engineering, University of Georgia, Athens, Ga. (Mail) Box 163, Griggs Hall

Harms, H. F.—Agricultural representative, British Columbia Electric Co., Ltd. (Mail) 2580 Roseberry Ave., West Vancouver, B. C., Canada

Head, Glenn D., Jr.—Design engineer, John Deere Des Moines Wks., Des Moines, Iowa. (Mail) 4027 6th Ave.

Heller, Raymond H.—Experimental engineer, John Deere Dubuque Tractor Wks., Dubuque, Iowa. (Mail) 2064 Broadlawn Rd.

Henderson, Paul H., Jr.—Assistant in managing farm, 331 West Main St., Halls, Tenn.

Hoener, Wm. D.—Field engineer, Purolator Products, Inc. (Mail) 717 West 46th St., Kansas City, 2, Mo.

Hoh, David H. C.—P. O. Box 565, Iowa City, Iowa

Holmquist, Nils T.—Chief engineer, Swedish Government Research Institute for Farm Buildings, Kyrkogatan 2, Lund, Sweden.

Ibrahim, A. Aly—Graduate student in agricultural engineering, Iowa State College, Ames, Iowa

Imperial, Leonard J.—In charge of research and development, Valves and Presses, Delaware, Ohio

Isaacs, Gerald W.—Instructor in agricultural engineering, Purdue University, Lafayette, Ind.

Jacobs, W. R.—Manager of wheat ranch, c/o J. W. Stine, Connell, Wash.

Johnson, William H.—Assistant agricultural engineer, Ohio Agricultural Experiment Sta. (Mail) Ives Hall, Ohio State University Columbus, Ohio

Jones, Freeland—Farm manager, Gray Stone Farm. (Mail) R. R. 7, Bangor, Maine

Kemppainen, Walter R.—Field instructor, Dearborn Motors Corp., Detroit, Mich. (Mail) 1712 Tyler Ave.

Kittle, H. E.—Assistant instrument man, Prairie Farm Rehabilitation Act. (Mail) Myrtle Hotel, Bow Island, Alta, Canada

Kliever, Waldo H.—Director of research, Minneapolis-Honeywell Regulator Co. 2753 Fourth Ave., S., Minneapolis, Minn.

Kollmayr, William R.—Director service representative, New Jersey Power & Light Co., 9 W. Blackwell St., Dover, N. J.

Kromer, O. W.—Owner and engineer, O. W. Kromer Co., 1120 Emerson Ave., N., Minneapolis, Minn.

Livingston, James K.—Agricultural engineer, Soil Conservation Service, USDA. (Mail) 302 New Second St., Natchitoches, La.

Lund, Carl M.—Supervisor of service, Atlanta Branch, J. I. Case Co. (Mail) 705 University Ave., S. W., Apartment 7, Atlanta, Ga.

Maclaren, J. H., Jr.—Sales and service manager, tractor and implement div., Ford Motor Co. of Canada, Windsor, Ont., Canada. (Mail) 1209 Kildare Rd.

Maxwell, Noel R.—Assistant superintentendent, Chapman Chemicals, Ltd., 1040 Lynn Ave., Winnipeg, Man., Canada

Moore, Dale R.—Junior experimental engineer, Oliver Corp., Springfield, Ohio. (Mail) 629 E. High St.

Norby, Loren H.—Laboratory testing, John Deere Dubuque Tractor Wks., Dubuque, Iowa. (Mail) 1387 Delhi

Oatney, R. D.—Engineer, Franklin Soil Conservation District. (Mail) Pleasantville, Ohio

O'Brien, W. E.—Engineer in agricultural engineering, University of Saskatchewan, Saskatoon, Sask., Canada. (Mail) 1118 College Dr.

Pasturczak, F. Stanley—Experimental design engineer, John Deere Harvester Wks, East Moline, Ill.

Patronsky, Richard J.—Agricultural engineer (drainage), Soil Conservation Service, USDA. (Mail) 66 E. Frambes Ave., Columbus, Ohio.

Penfold, Ronald E.—Product engineer, International Harvester Co. of Canada, Hamilton Works, Hamilton, Ont., Canada

Phillips, Dean O.—Chief engineer, Engine Parts Mfg. Co., 1360 W. Ninth St., Cleveland 13, Ohio

Pistilli, August D.—Graduate assistant in agricultural engineering, Cornell University, Ithaca, N. Y.

Randolph, Geo. G.—Utilization engineer, Tallahatchie Valley Electric Power Assn., Batesville, Miss.

Rapp, Egon—Instructor in agricultural engineering, Agricultural and Homemaking School, Brandon, Man., Canada

Reeves, Beverly G.—Farmer, R. R. 4, Abilene, Tex. *(Continued on page 44)*

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RELIABLE PERFORMANCE • COMPETITIVELY PRICED
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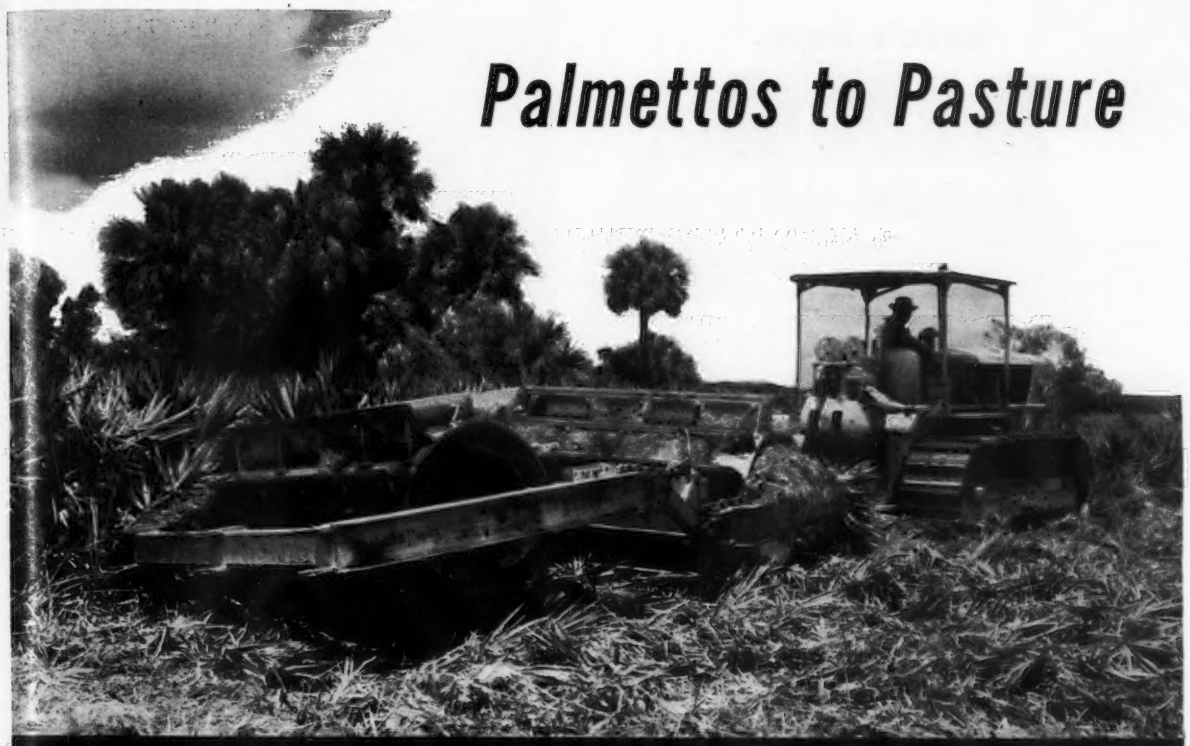

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Zinc, used in galvanizing countless parts of farm machinery and equipment, gives rugged, long-time protection against rust.
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- ☐ Facts about Galvanized Sheets
- ☐ Use of Metallic Zinc Paint to Protect Metal Surfaces

Name_____

Address_____

Town_____ State_____

Applicants for Membership

(Continued on page 42)

Rhodes, H. G.—Teacher of farm machinery, Ashwood Area Vocational Farm and Home School, Bishopville, S. C. (Mail) R. R. 3

Rice, Tunis F.—Assistant district service supervisor, International Harvester Co. (Mail) 315 W. Genesee Ave., Saginaw, Mich.

Riecken, Robert J.—Agricultural engineer, Lands Branch, Saskatchewan Department of Agriculture. (Mail) 850 University Dr., Saskatoon, Sask., Canada

Ritchie, De Vere, Jr.—Tractor works, International Harvester Co., Chicago, Ill. (Mail) 6342 S. Sacramento Ave.

Schrunk, John P.—Teaching and research in agricultural engineering, University of Nebraska, Lincoln, Nebr.

Scofield, Francis—Chemist, National Paint, Varnish, and Lacquer Assn., 1500 Rhode Island Ave., N. W., Washington 5, D. C.

Scott, E. B.—Division manager of agricultural sales, Public Service Co. of Northern Ill. (Mail) 32 Cass St., Joliet, Ill.

Sharpe, John C.—Salesman, Charlotte Farm Equipment Co., Charlotte, N. C. (Mail) 2300 N. Tryon St.

Svensson, Karl-Ake—Research engineer, Swedish Institute of Agricultural Engineering, Uppsala 7, Sweden

Talbott, William G.—Junior project engineer, Dearborn Motors Corp., Detroit, Mich. (Mail) 93 Seward Ave.

Taup, Milton J.—District manager, Vickers, Inc., 2400 W. Madison St., Chicago 12, Ill.

Thomas, David E., Jr.—Junior engineer, Hertzler & Zook Co., Belleville, Pa.

Townsend, Vernon T.—Junction City Implement Co., P. O. Box 66, Junction City, Ore.

Turner, W. J.—Research assistant in agricultural engineering, Cornell University, Ithaca, N. Y.

Tyson, Stephen E., Jr.—Serviceman, Allis-Chalmers Mfg. Co. (Mail) 2005 Ashland Ave., Charlotte, N. C.

Walker, Darrell W.—Service manager, Northwest Tractor & Equipment Co., Inc., 419 North 5th St., Minneapolis, Minn.

Williamson, Leslie H.—Assistant engineer in design, Hocking Valley Mfg. Co. (Mail) 150 W. Norwich Ave.

Wilson, Raymond W.—Junior project engineer (research), Dearborn Motors Corp. (Mail) 2441 Shevlin, Ferndale 20, Mich.

Woodson, Watkins W.—Agricultural engineer, Rural Electrification Adm., USDA. (Mail) R. R. 1, Box 114 A, Hyattsville, Md.

TRANSFER OF GRADE

Dale, Alvin C.—Research assistant professor of agricultural engineering, Iowa State College, Ames, Iowa. (Junior Member to Member)

Johnson, William H.—Instructor in agricultural engineering, State College of Washington, Pullman, Wash. (Mail) 206 Agricultural Engineering Bldg. (Junior Member to Member)

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RATES: Announcements under the heading "Professional Directory" in AGRICULTURAL ENGINEERING will be inserted at the flat rate of $1.00 per line per issue; 50 cents per line to A.S.A.E. members. Minimum charge, four-line basis. Uniform style setup. Copy must be received by first of month of publication.

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. . . and remember

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you can mow, chop and load, in one operation, over 200 tons of grass silage a day

you can cut corn of any height, chop and load it into wagons, all in one operation.

One man, with the FOX, can pick up, chop and load, ready for the mow or stack, 2 tons of dry hay in 12 minutes.

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When you own a Fox Forage Master, you own the leader in the field. The Fox is backed by 14 years of field-proven, trouble-free performance.

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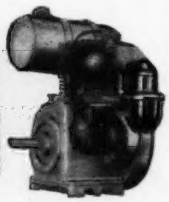

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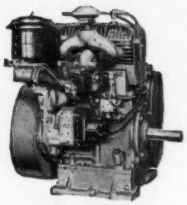
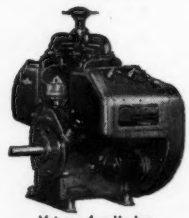


Two Cylinder, 7 to 13 hp.



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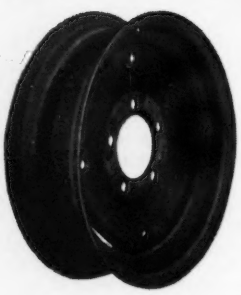

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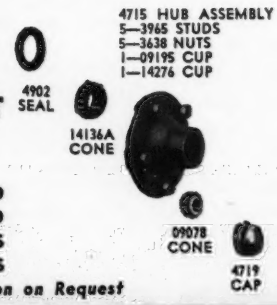

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NEWS FROM ADVERTISERS

New Products and Literature and Business Changes Announced by AGRICULTURAL ENGINEERING Advertisers

"Facts About Douglas Fir Plywood" is a new booklet published by the Douglas Fir Plywood Assn., reporting on volume, trends, and activities in the industry.

Achieving a 70 per cent production increase since the end of the war, the expanded Douglas fir plywood industry will manufacture a record two billion square feet of panels in 1948 to supply unprecedented demand for plywood in construction and industry.

Under the new U. S. Commercial Standard CS45-48 (grading rules) effective Nov. 1, new grades are being introduced to meet express building needs, a new simplified system of grade identification has been adopted and performance requirements for exterior (waterproof) plywood have been made more rigid than ever.

The booklet records that 66 per cent of plywood is produced with one side only of high quality veneer with the back of economical, lower quality wood as "experience has shown that in the great bulk of plywood uses, only one face of the panel is exposed."

The booklet is concluded with a review of "what's ahead in plywood." Here, briefly, is the six-point program:

1 Continued increased production with a higher proportion of the exterior type all-purpose material.

2 Constant betterment of product.

3 Continued sale of a high proportion of plywood through distributors and dealers, and continued supply of industrial users.

4 Conservation of the natural resource, timber, through ever higher utilization of raw material.

5 Continued product research.

6 Continued aggressive promotion of Douglas fir plywood, now a basic building commodity.

A copy of the 24-page facts booklet will be furnished free upon request to Douglas Fir Plywood Assn., Tacoma 2, Wash.

Massey-Harris' new four-color tractor catalog covers their complete line-up of six basic tractor models in five power sizes ranging from the one-plow "Pony", through the two-plow up to the heavy power-packed four-five plow. Of special interest is Massey Harris' newest model two-plow "22" tractor, featuring Depth-o-matic system with fast-working attachments and trigger-latch hookup. Special equipment and attachments for various field operations are explained in relation to tractor power class. Specification outlines cover each Massey-Harris tractor in relation to regular equipment — engine, rating, etc.

Westinghouse Electric Corp. recently issued a new booklet "How to Apply Motors and Controls to Farm Jobs," as an addition to its application data series on "Productive Power on the Farm." Copies are available from dealers and the Rural Electrification Department of the Company, Pittsburgh, Pa.

John Deere Diesel Tractor. Production of the most powerful tractor ever built by John Deere — the new Model "R" Diesel — is under way at the John Deere Tractor Works in Waterloo, Iowa. Built to match the needs of large-acreage farmers throughout the country, this new wheel-type tractor represents 12 years of designing, developing, and testing under severe field conditions. Power to handle four or five-bottom plows, diesel fuel economy, and extreme simplicity made possible by two-cylinder engine design, are its outstanding advantages. The Model "R" has John Deere hydraulic Powr-Trol for control of heavy implements. Both Powr-Trol and the power shaft are controlled by an independent clutch for continuous operation when desired. Speeds range from a low of approximately 2 mph to nearly 11.5 mph for transporting. An auxiliary two-cylinder engine provides easy starting. Other features include deep-cushion seat, step-up platform, unobstructed view, foot-operated differential brakes, and balanced weight with a highly-efficient steering mechanism.

New John Deere Model "MT" tractor pulling two-row stalk cutter

Jamesway Equipment

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SAVES 1½ HOURS

EVERY DAY . . . INCREASES MILK 10%

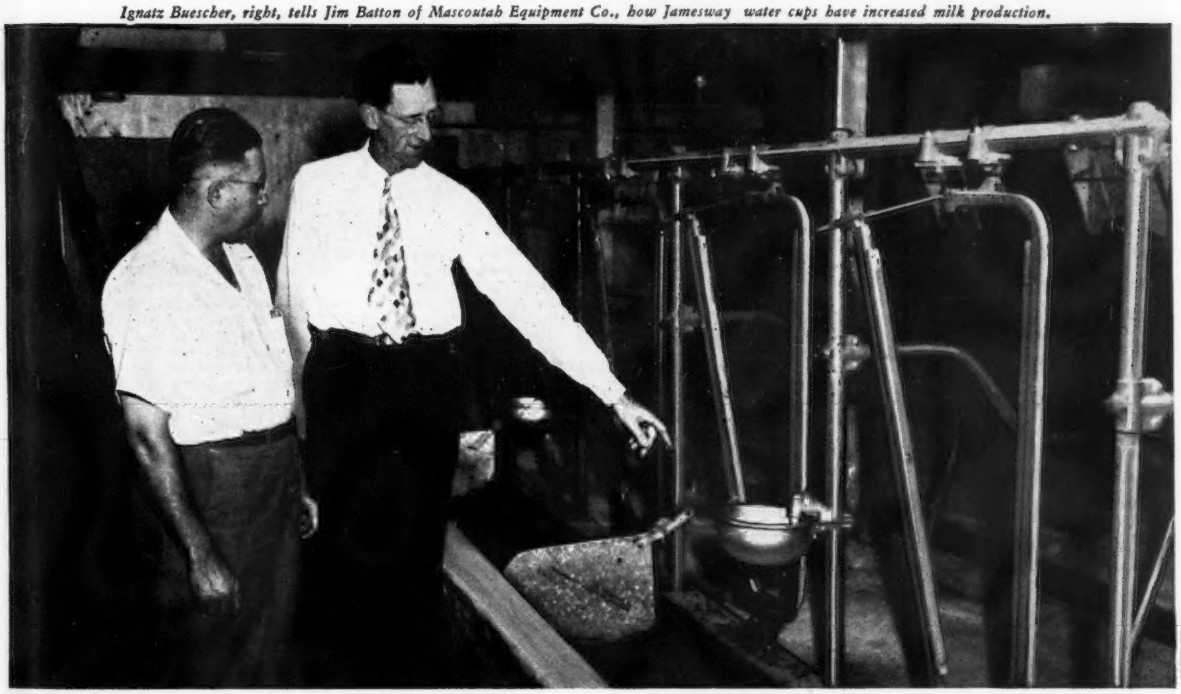
Says Ignatz Buescher, Venedy, Ill., farmer

Gone forever—1½ hours of needless, tiresome, back-breaking drudgery! In its place, Mr. Buescher has gained *extra* time to do all his chores even better. That extra time plus Jamesway equipment means higher production — *bigger* profits!

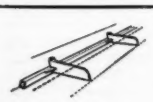
"I save up to 30 minutes a day with Jamesway stalls and stanchions," Mr. Buescher says. "I save an hour with my Jamesway water cups. Add to that the time I save with Jamesway ventilation and other equipment and you can see how I have cut my chores 1½ hours. My herd is easier to handle and my milk check has increased 10%."

Now's the time for you, too, to modernize with Jamesway! Drudgery is *expensive!* Don't let it rob you of precious time and money. Jamesway equipment costs surprisingly little. Lasts for years and years. See your dealer. For literature, write James Mfg. Co., Fort Atkinson, Wis., Dept. A-149

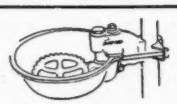
Ignatz Buescher, right, tells Jim Batton of Mascoutah Equipment Co., how Jamesway water cups have increased milk production.



✓ Check this Jamesway Chart to see how much time you can save



☐ Save an hour a day with Jamesway barn cleaner.



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☐ Save time and feed with Jamesway "Pork Maker" hog feeders.

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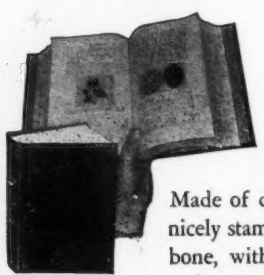

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Personnel Service Bulletin

The American Society of Agricultural Engineers conducts a Personnel Service at its headquarters office in St. Joseph, Michigan, as a clearing house (not a placement bureau) for putting agricultural engineers seeking employment or change of employment in touch with possible employers of their services, and vice versa. The service is rendered without charge, and information on how to use it will be furnished by the Society. The Society does not investigate or guarantee the representations made by parties listed. This bulletin contains the active listing of "Positions Open" and "Positions Wanted" on file at the Society's office, and information on each in the form of separate mimeographed sheets, may be had on request. "Agricultural Engineer" as used in these listings, is not intended to imply any specific level of proficiency, or registration, or license as a professional engineer.

NOTE: In this Bulletin the following listings still current and previously reported are not repeated in detail. For further information see the issue of AGRICULTURAL ENGINEERING indicated.

POSITIONS OPEN: 1948. APRIL—O-612, 615. JULY—O-624, 627, 629, 630. SEPTEMBER—O-641. OCTOBER—O-643, 648. NOVEMBER—O-650, 651, 652, 653.

POSITIONS WANTED: 1948 MARCH—W-146. APRIL—W-158. MAY—W-169. AUGUST—W-184, 189. OCTOBER—W-194. NOVEMBER—W-196, 197, 198, 199, 200, 201, 202, 203, 204. DECEMBER—W-205, 206, 207, 208, 209.

NEW POSITIONS OPEN

FIELD SERVICE men (2) to handle field service problems and conduct schools for dealer personnel, as representatives of Michigan area distributor for Ford tractors and Dearborn equipment. Prefer recent graduate in agricultural engineering, or equivalent. Farm background; actual experience in operation or service of a variety of modern farm field implements; and teaching experience desirable. Should be able to meet and work smoothly with other company personnel, dealers, and farmers. Location and travel in Michigan. Young and growing organization of young men, with growing business, offers excellent opportunity for man adapted to farm equipment distributing business. Age 22-30. Salary open. O-654

AGRICULTURAL ENGINEER to assist chief engineer in the design and layout of prefabricated metal farm buildings. Graduate with BS deg in agricultural engineering or equivalent preferred. Recent graduate acceptable if able to qualify for state license in civil engineering. Should be able to work with others in the organization. Opportunity up to individual. Salary open. O-655

NEW POSITIONS WANTED

AGRICULTURAL ENGINEER desires work in power and machinery field, preferably in design, development, or research with private company. Major technical interest is in internal combustion engines; second interest in power operated farm equipment. BS deg in agricultural engineering, Ohio State University expected March 1949. Farm background. Training in operation and maintenance of heavy equipment and internal combustion engines in Corps of Engineers. War service 23 mo, including commissioned service as company commander. Student assistant in chemistry, University Research Foundation, 2 yr. No disability. Available April 1. Single. Age 22. Salary open. W-211

AGRICULTURAL ENGINEER desires work in land drainage and operation of ditchers. BS deg in agricultural engineering, Macdonald College, 1948. Assistant agricultural engineer, Nova Scotia department of agriculture, 18 mo. Operating own drainage business, 7 mo. No disability. Available as soon as visa can be obtained. Single. Age 24. Salary $2600. W-212

AGRICULTURAL ENGINEER desires development and research work in farm structures, with private company. BS deg in agricultural engineering, University of Georgia, 1947. MS deg in agricultural engineering expected February 1949, University of Illinois. Research in farm structures half time, 1½ yr, University of Illinois. War service in Army, 23 mo. No disability. Available February 7. Single. Age 24. Salary open. W-213

AGRICULTURAL ENGINEER desires design, development or research work in farm structures or power and machinery field, with private company or government agency. BS deg in agricultural engineering expected in February, University of Maine. General farming background. Three summers experience as a construction carpenter. War service in Navy, 1 yr. No disability. Available February 15. Married. Age 26. Salary open. W-214

AGRICULTURAL ENGINEER desires research, development, or service work in power and machinery; or research or project engineering in the soil and water field. BS deg in agricultural engineering, South Dakota State College, 1947. Service engineer for farm equipment manufacturer, 4 mo; farming, 5 yr. No disability. Available January 15. Married. Age 28. Salary open. W-215

AGRICULTURAL ENGINEER desires design, development, or service work in soil and water or farm structures field. BS deg in agriculture, 1948, University of Florida; major in agricultural engineering with emphasis on irrigation and drainage. Mechanics helper 6 mo since graduation. War service in Coast Artillery. Disability 10 per cent due to service injury to left lung. Condition improving. Available April 15. Single. Age 25. Salary $2700. W-216